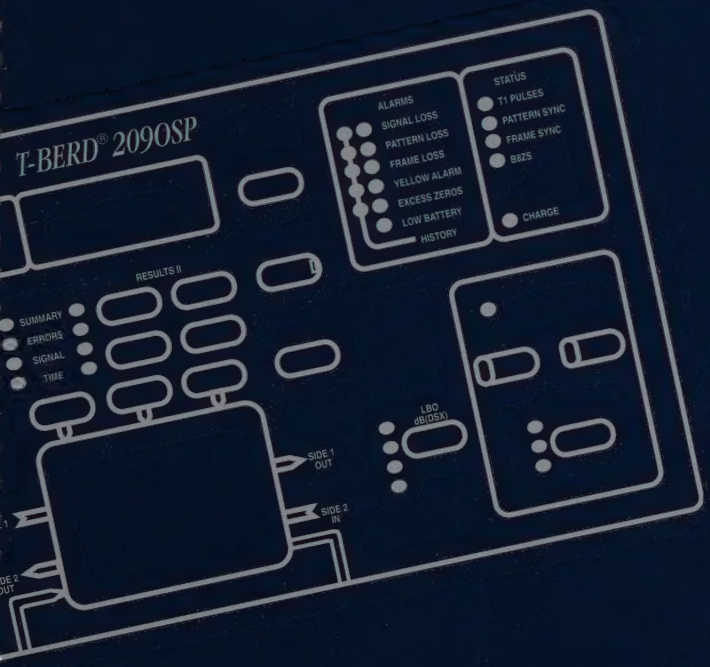
# T-BERD® 209OSP




## T-Carrier Analyzer User's Guide

TTC™
A Dynatech Company

50-12540-01
Rev. G

# T-BERD 209*OSP*
# T-CARRIER ANALYZER

# USER'S GUIDE

JULY 1995

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20400 Observation Drive
Germantown, Maryland 20876
(800) 638-2049 • (301) 353-1550 (MD) • FAX (301) 353-9216
WWW Address: http://www.ttc.com

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## BASIC SETUPS

### Connecting the T-BERD 209*OSP* at Mid-Span

### Generating Printouts

### Timed Test Setup

# BASIC SETUPS

## 1. Connecting the T-BERD 209*OSP* at Mid-Span
### *T-BERD T1 Repeater Adaptor Required*

The T-BERD 209*OSP* provides three types of connections for access to the T1 circuit, WECO 310 jacks (RECEIVE, TRANSMIT/TDR, and T1 REF), RJ48 phone jack (LINE), and T-BERD T1 Repeater Adaptor interface port (T1 REPEATER PORT). Each type of connection has test locations for which it is best suited, as shown in Table 1.

The T1 REPEATER PORT connector, which is used with the T-BERD T1 Repeater Adaptor to provide T1 circuit access at a repeater housing, is the only connection that enables use of the AUTOTEST feature.

Table 1
T1 Circuit Test Locations

| Location | Cable Used | T-BERD 209*OSP* Connection |
|---|---|---|
| DSX-1 patch panel | 310 plug to bantam plug cables or 310 plug to 310 plug cables | RECEIVE and TRANSMIT/TDR jacks |
| Distribution frame | 310 plug to alligator clip cables | RECEIVE and TRANSMIT/TDR jacks |
| Lightning Protection Block | 310 plug to 303 plug cables | RECEIVE and TRANSMIT/TDR jacks |
| Mid-span repeater | | |
| Repeater Adaptor | Repeater Adaptor cable | T1 REPEATER PORT |
| Repeater Extender | 310 plug to 310 plug cables | RECEIVE and TRANSMIT/TDR jacks |
| NIU | RJ48 to RJ48 cable | LINE jack |
| | 310 plug to bantam plug cables | RECEIVE and TRANSMIT/TDR jacks |
| CSU | 310 plug to bantam plug cables | RECEIVE and TRANSMIT/TDR jacks |

This procedure enables you to connect the T-BERD 209*OSP* to a T1 span at a span repeater location in order to test the span in either direction. Figure 1 illustrates how the T-BERD 209*OSP* and the T-BERD T1 Repeater Adaptor are connected to the T1 span.

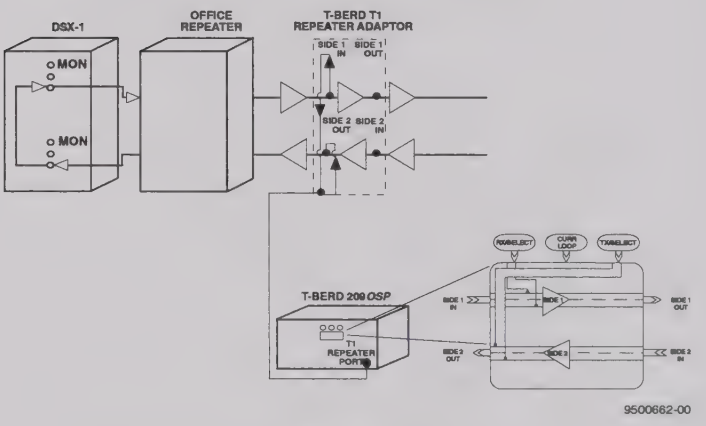



Figure 1
Testing from Mid-Span

### *T-BERD T1 Repeater Adaptor Test Setup*

1. **Remove repeater**

   Unplug the desired repeater from the repeater housing unit and plug the repeater into the T-BERD T1 Repeater Adaptor.

   CAUTION: Removing the repeater will disable the selected T1 span line.

2. **Connect the T-BERD T1 Repeater Adaptor to the T-BERD 209*OSP***

   Connect the T-BERD T1 Repeater Adaptor cable to the T1 REPEATER PORT connector.

3. **Insert T-BERD T1 Repeater Adaptor**

   Plug the T-BERD T1 Repeater Adaptor into the desired repeater slot.

### *T-BERD 209OSP Test Setup*

1. **Configure the T-BERD 209*OSP* switches:**

| | |
|---|---|
| **POWER** | ON. |
| **MODE** | Desired T1 framing mode. |
| **PATTERN** | Desired pattern. |
| **B8ZS** | B8ZS (LED ON), if appropriate. |
| **TIMED TEST** | Continuous (LED extinguished). |
| **RCV'D** | Internal timing (LED OFF). |
| **RECEIVE INPUT** | TERM. |
| **LBO** | 0 dB. |
| **RX/SELECT** | Press to assign receiver to the desired position. |
| **TX/SELECT** | Press to assign transmitter to the desired position. |

2. **Configure T-BERD 209*OSP***

   Configure the T-BERD 209*OSP* with the appropriate loop codes to establish a test loopback at the appropriate terminal.

## 2. Generating Printouts

Use the following information to configure the T-BERD 209*OSP* and compatible printer, such as the TTC PR-40A Thermal Printer or RS-232 compatible printer, to generate results and controls printouts. The printer connection is the AUXILIARY PORT connector on the front panel.

If a printer is not available, you can still generate printouts and store them in the internal print buffer. This procedure assumes you know how to set up the printer for proper operation (refer to the printer operating manual for operating procedures).

1. **Apply power to the T-BERD 209*OSP***
   Press the **Power** switch on the connector panel. Verify that instrument start up and self test are satisfactory.

2. **AUX switch**
   Press to illuminate the LED. Verify that the character display changes to an auxiliary function display.

3. **PATTERN switch**
   Set the RS-232 interface parameters using the AUX PRNTPORT function:

| Parameter | Selections | Comments |
|---|---|---|
| BAUD RATE | 300, 1200, 2400, 4800, or 9600 | Set baud rate to match printer. |
| PARITY | EVEN, ODD, or NONE | Set parity to NONE when printing optional TDR graphs. |
| TERM 232 | CR or CRLF | Set the printout line terminator. CR should be used when printing optional TDR graphs. |

4. **AUX switch**

   Press to extinguish the LED. The character display should return to the previous operating mode.

5. **Turn OFF the T-BERD 209*OSP***

   Press the **Power** switch down and release. The switch should return to the upright, OFF position.

6. **Connect a printer to the T-BERD 209*OSP***

   Connect the printer to the T-BERD 209*OSP* AUXILIARY PORT connector using a circular 8-pin DIN-type to 25-pin D type connector cable (Model #30758).

7. **Apply power to the T-BERD 209*OSP* and printer**

   Turn the T-BERD 209*OSP* on first, then the PR-40A. If this step is reversed, the first printout can be garbled.

   NOTE: When connecting a compatible printer other than the PR-40A to the T-BERD 209*OSP*, connect the printer to the T-BERD 209*OSP*, turn the printer power on first, and place the printer OFF LINE before turning the T-BERD 209*OSP* ON.

8. **Place the printer ON LINE**

   The PR-40A must be placed ON LINE manually (see the *PR-40A Thermal Printer Operating Manual*).

   NOTE: When the printer is placed ON LINE the T-BERD 209*OSP* immediately sends any printouts stored in memory.

9. **PRINT switches**

   Press either the **RESULTS** switch or the **CONTROLS** switch to generate either a results or controls printout, respectively.

10. **PRINT EVENT switch**

    Press to select the desired print event function, OFF, TIMED, or ERROR.

## 3. Timed Test Setup

This procedure enables you to run an unattended test for an extended period and collect test results during and after the test. Perform the following procedure to set up the T-BERD 209*OSP* for a timed test and print the results at the end of the test. Specific results printouts are generated during the test by selecting the desired print event function with the **PRINT EVENT** switch.

1. **Connect a printer to the T-BERD 209*OSP***
   Refer to *Basic Setups, Procedure 2* to connect a printer.

2. **AUX switch**
   Press to illuminate the LED. Verify that the character display changes to an auxiliary function display.

3. **PATTERN switch**
   Set the AUX TEST LEN functions for the desired test duration.

| | | |
|---|---|---|
| **AUX** | **TIME TEST LEN** | |
| **TEST LEN** | **200 HRS** | **00 MIN 00 SEC** |

4. **AUX switch**
   Press to extinguish the LED. The character display should return to the previous operating mode.

5. **PRINT EVENT switch**
   Select the ERROR position to automatically generate a results printout once each errored second.

   Select the TIMED position to periodically generate results printouts based on the time interval specified by the AUX PRINT INT function.

   Select the OFF position to prevent automatic results printout generation.

6. **TIMED TEST switch**

   Press to illuminate the switch LED (changing from continuous to timed testing causes a test restart).

7. **RESULTS switches**

   Select the TIME category TEST END IN result in the RESULTS I display and the SUMMARY category in the RESULTS II display.

| | | |
|---|---|---|
| **T1 D4** | **TEST END IN** | **ALL** |
| **2 IN 8** | **000:26:35** | **RESULTS OK** |

   When the RESULTS I display reaches 000:00:00, the test is complete, TIMED TEST COMPLETE flashes in the character display, and the test result counts are frozen.

8. **Evaluate the test results**

   When the test is complete, evaluate the results by either scrolling through the frozen results or scanning the printouts.

# APPLICATIONS

This section provides information on operating the T-BERD 209*OSP* in a variety of common test applications. Each application describes how to configure the T-BERD 209*OSP*, connect to the circuit being tested, and interpret the test results. If an option is required, the option is indicated in the title of the application. The test scenarios and instrument setups are grouped into the following applications:

**Testing T1 Networks**

**DC Testing**

**TDR Testing**

**Advanced Testing**

**HDSL Testing**

**Testing Digital Loop Carrier (DLC) Networks**

**DDS Local Loop Testing**

**ISDN Local Loop Testing**

# TESTING T1 NETWORKS

In-Service Monitoring

NIU/CSU Loopback Testing

Loss Testing

NIU/CSU Emulation

Measuring T1 Timing Slips

Repeater Testing

AUTOTEST

Start up Testing of Multiple T1 Lines

TESTING T1 NETWORKS

## 4. In-Service Monitoring

- Non-intrusively monitors the T1 facility.
- Confirms that the T1 signal is properly received by the network equipment.
- Monitors the T1 signal for BPVs, frame errors, and CRC errors (ESF framing only).
- Measures the T1 signal level and frequency.

1. **Configure the T-BERD 209*OSP* switches:**

| | |
|---|---|
| **POWER** | **ON.** |
| **MODE** | AUTO. |
| **RECV'D** | Select recovered timing (LED ON). |
| **TIMED TEST** | Continuous (LED extinguished). |
| **RECEIVE INPUT** | DSX-MON. |

2. **T1 circuit connection**

   Connect a cable from the RECEIVE jack to the DSX-1 MON jack (see Figure 2). The return signal is monitored after it has passed through the office repeater.

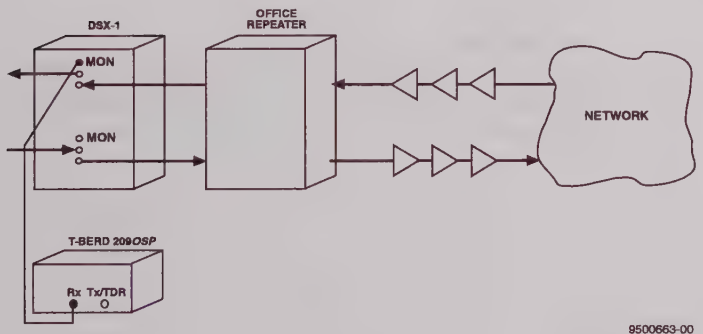



Figure 2
In-Service Monitoring Setup

3. **RESTART switch**

   Press the **RESTART** switch to clear any test results and momentary alarms.

4. **Status LEDs**

   These LEDs should illuminate: T1 Pulses, Frame Sync, and B8ZS (if applicable).

5. **RESULTS I switches**

   Select the SUMMARY category. If *ALL RESULTS OK* is displayed and no Alarm LEDs are illuminated, the circuit is operating within specifications.

   If errors are detected, the RESULTS I display automatically scrolls through one or more results. To momentarily stop the scrolling press either **RESULTS I Results** switch (up or down arrow). Check the other categories as required.

6. **Results interpretation**

   **VIOLATIONS only**

   These errors typically indicate a local T1 span problem caused by a bad splice, water on the cable, crosstalk, bad repeater, or defective DSX jacks.

   **FRM ERRORS (CRC ERRORS if ESF framing)**

   These errors typically indicate a span line problem between you and the last piece of transmission equipment that framed the signal.

   **RX FREQ, Hz**

   The DS1 received frequency should be 1.544 MHz ±77 Hz. If the frequency is out-of-specification, check the transmission equipment timing or the network synchronization.

**RX LEVEL (dBdsx)**

The received level should be -20 dBdsx ±3.5 dBdsx at resistor isolated DSX-1 MON jacks. Incorrect levels could be caused by a faulty T1 line card or poor cabling between the DSX jack and the equipment.

**Yellow Alarm LED**

This alarm LED indicates a problem in the transmission leg of the span.

7. **Circuit disconnect**

Once you have completed the in-service monitoring, remove the cable from the DSX-1 MON jack and turn off the instrument.

## 5. NIU/CSU Loopback Testing

- Qualifies T1 circuit error performance by testing for logic errors, BPVs, frame errors, and CRC errors (if applicable) on T1 lines.

- Checks loopback response of transmission equipment.

- MULTIPAT pattern selection automatically transmits five Bellcore approved test patterns (ALL ONES, 1:7, 2 IN 8, 3 IN 24, and QRSS) to perform a one-step qualification of T1 span lines.

- BRIDGTAP pattern selection automatically transmits 21 patterns that are composed of varying degrees of ones and zeros densities to detect the presence of most bridge taps on T1 span lines.

1. **Apply power to the T-BERD 209*OSP***
   Press the **Power** switch on the connector panel. Verify that instrument start up is satisfactory.

2. **Configure the T-BERD 209*OSP*:**

| | |
|---|---|
| **MODE** | Select appropriate T1 framing format. |
| **PATTERN** | Select desired test pattern. If intending to use MULTIPAT and BRIDGTAP automated patterns, use the MULTIPAT pattern sequence first, followed by the BRIDGTAP sequence. |
| **B8ZS** | B8ZS (LED ON), if appropriate (if pattern is BRIDGTAP, select AMI). |
| **TIMED TEST RECV'D** | Continuous (LED extinguished). Select internal timing (LED extinguished). |
| **RECEIVE INPUT** | TERM. |
| **LBO** | 0 dB. |
| **AUX RESPONSE** | NO RESPONSE. |

**AUX LOOPCODE** — CSU — IN-BAND, ESF LINE, or ESF PAYLOAD, as appropriate. NIU — FAC1, FAC2, FAC3, or ESF NET, as appropriate.

3. **T1 circuit connection**

If testing at a DSX-1 patch panel, connect a cable from the RECEIVE jack to the DSX-1 OUT jack. Connect a cable from the TRANSMIT/TDR jack to the DSX-1 IN jack (see Figure 3).

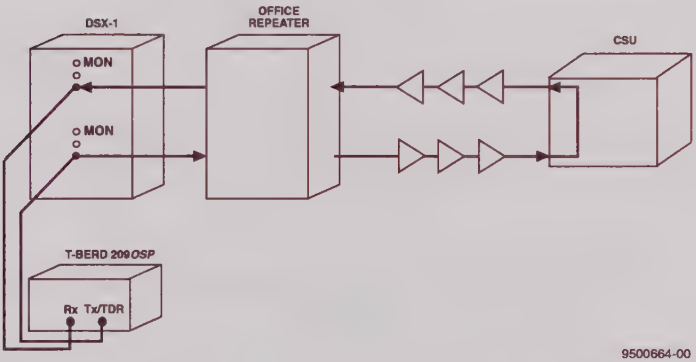



Figure 3
CSU Loopback Testing From a DSX-1 Patch Panel

If testing at a mid-span repeater housing (see Figure 4), unplug the desired repeater from the repeater housing unit and plug the repeater into the T-BERD T1 Repeater Adaptor. Connect the T-BERD T1 Repeater Adaptor cable to the T1 REPEATER PORT connector. Plug the T-BERD T1 Repeater Adaptor into the desired repeater slot.

CAUTION: Removing the repeater will disable the selected T1 span line.

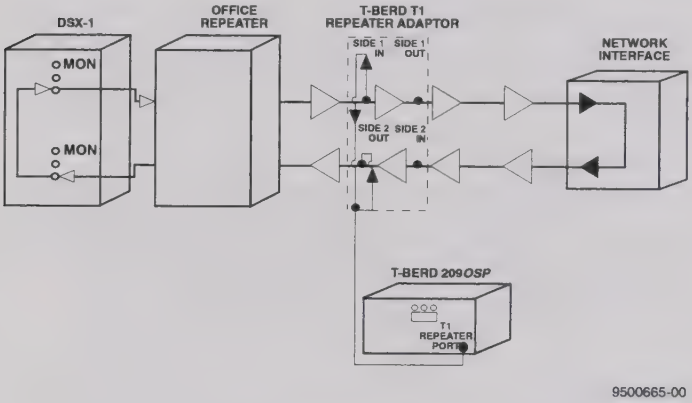



Figure 4
NIU Loopback Testing with the T-BERD T1 Repeater Adaptor

4. **RESTART switch**

   Press to clear any spurious alarms than may have occurred during T1 circuit connection.

5. **LOOP UP switch**

   Press the **LOOP UP** switch to send the selected loop-up code toward the customer premises. Observe the switch LED illuminates and remains illuminated until the loopback is established (approximately seven seconds for in-band loop codes).

6. **Status LEDs**

   These LEDs should illuminate: T1 Pulses, Pattern Sync, Frame Sync, and B8ZS (if applicable).

7. **RESULTS I Category switch**

   Select the SUMMARY category.

8. **ERR INS switch and RESULTS I display**

Press this switch five times to verify that the logic errors and BPVs are received and the T1 circuit is looped back.

NOTE: If the loopback is not established, the bit errors do not appear in the display. The failed loopback could be because the NIU/CSU is not operating correctly, the line from the instrument to the NIU/CSU is bad, or the transmitted loop code is incorrect.

**BIT ERRORS**
**5**

**VIOLATIONS**
**5**

9. **RESTART switch**

Press to clear the results and start the test. If using the MULTIPAT or BRIDGTAP patterns, the PATTERN display alternates between the transmitted test pattern in lowercase characters and MULTIPAT or BRIDGTAP, as appropriate.

10. **RESULTS I switches**

If errors are not detected, *ALL RESULTS OK* appears. If errors are detected, observe the RESULTS I display for specific errors. Check the other categories as required.

**ALL RESULTS**
**OK**

## 11. Results interpretation

### *Standard BERT Testing*

**BIT ERRORS only**
Check the span before the DSX-1 by isolating sections and testing.

**VIOLATIONS only**
These errors typically indicate a local T1 span problem caused by a bad splice, water on the cable, crosstalk, bad repeater, or defective DSX jacks.

**BIT ERRORS and VIOLATIONS**
These errors typically indicate a local T1 span problem caused by a bad splice, water on the cable, crosstalk, or defective DSX jacks.

**RX FREQ, Hz**
The DS1 received frequency should be 1.544 MHz ±77 Hz. If the frequency is out-of-specification, check the transmission equipment timing or the network synchronization.

**RX LEVEL (dBdsx)**
The received level should be +4 to -4 dBdsx at the terminated DSX-1 OUT jacks. Incorrect levels could be caused by a faulty T1 line card or poor cabling between the DSX jack and the equipment.

When testing at a mid-span repeater, if the signal level is wrong at the output of the repeater, use the **RX/SELECT** switch to move the receiver to SIDE 2 IN. If the signal level is correct on the input to the repeater, the problem could be the repeater itself or a ground/short on the span just beyond the repeater. Move the receiver to SIDE 1 OUT. If the signal level is wrong on the output of the repeater, the problem could be the repeater itself or a ground/short on the span just beyond the repeater. A DC test or TDR test of the span would help determine the location of the fault.

**Yellow Alarm LED**
The far end sends a Yellow Alarm to indicate that it is not receiving a T1 signal. Sectionalize the T1 equipment further.

## *BRIDGTAP or MULTIPAT Testing*

***ALL RESULTS OK***
No errors were detected with the MULTIPAT and BRIDGTAP test.

***FAILED MULTIPAT PATTERNS***
If 3 IN 24 failed, it indicates a bad repeater (timing circuit) or one side of span is open.

If ALL ONES failed, it indicates a bad repeater (power output).

If 1:7 failed, it indicates a bad repeater (timing circuit) or one side of span is open.

If QRSS failed, it indicates a faulty cable.

***Errored Results — MULTIPAT Errors***
When all or part of the patterns fails, it generally indicates a malfunctioning repeater, multiplexer, or DSX. To determine the possible cause, repeat the individual failed pattern while monitoring the RESULTS display. If errors immediately start accumulating, there is a cabling problem. If no errors occur for a few minutes, and then a burst of errors occurs, the problem is a repeater.

***Errored Results — BRIDGTAP Errors***

When the errors are grouped around a number of patterns it indicates that a bridge tap exists on the span. Sectionalize the span to isolate the bridge tap.

Table 2 describes the results interpretation when testing a span with the MULTIPAT and BRIDGTAP pattern sequences.

Table 2
MULTIPAT and BRIDGTAP Test Results

| Test | Pass/ Fail | Errors Detected | Comments |
|---|---|---|---|
| MULTIPAT | Pass | No | No repeater problems. No bridge taps. |
| BRIDGTAP | Pass | No | |
| MULTIPAT | Pass | No | No repeater problems. Bridge taps on span, errors occur in groups |
| BRIDGTAP | Fail | Yes | around a number of patterns but do not affect MULTIPAT patterns. |
| MULTIPAT | Fail | Yes | Bridge taps on span if errors occur in groups around a number of patterns, including the MULTIPAT |
| BRIDGTAP | Fail | Yes | patterns. Possible repeater problems if BRIDGTAP pattern errors not grouped. |

12. **Printout generation**

If a hard copy record of the test results is desired, connect a printer to the T-BERD 209*OSP* and produce printouts in accordance with *Basic Setups, Procedure 2*.

13. **LOOP DOWN switch**

Press the **LOOP DOWN** switch to deactivate the loopback.

14. **Circuit disconnect**

If testing at a DSX-1 patch panel, remove the cable from the DSX-1 OUT jack and DSX-1 IN jack. Then, remove the cables from the RECEIVE and TRANSMIT/TDR jacks.

If testing at a mid-span repeater, remove the T-BERD T1 Repeater Adaptor from the repeater housing, remove the repeater from the T-BERD T1 Repeater Adaptor, replace the repeater in the repeater housing, and disconnect the Repeater Adaptor cable from the T1 REPEATER PORT.

## 6. Loss Testing

- Measures the T1 signal level in dBdsx and peak-to-peak volts.
- End-to-end testing with two test sets.
- Confirms that the T1 signal is properly processed by the network equipment.

1. **Configure the T-BERD 209*OSP* switches:**

| | |
|---|---|
| **POWER** | ON. |
| **MODE** | T1 unframed. |
| **PATTERN** | ALL ONES. |
| **TIMED TEST** | Continuous (LED extinguished). |
| **RECV'D** | Select internal timing (LED extinguished). |
| **RECEIVE INPUT** | TERM (BRIDGE if you have to bridge onto the line). |
| **LBO (dB)** | 0 dB. |
| **RESULTS I Category** | SUMMARY. |

2. **T1 circuit connection**

When testing at a mid-span repeater housing (see Figure 5), unplug the desired repeater from the repeater housing unit and plug the repeater into the T-BERD T1 Repeater Adaptor. Connect the T-BERD T1 Repeater Adaptor cable to the T1 REPEATER PORT connector. Plug the T-BERD T1 Repeater Adaptor into the desired repeater slot.

CAUTION: Removing the repeater will disable the selected T1 span line.

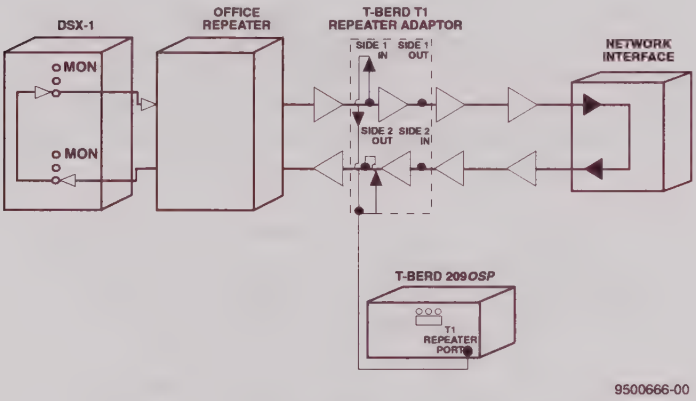



Figure 5
Loss Testing Setup

3. **RESTART switch**

   Press to clear any spurious alarms that may have occurred during T1 circuit connection.

4. **RX/SELECT and TX/SELECT switches**

   Start by testing the line between the repeater and the customer premises. Press the **TX/SELECT** switch to put the transmitter on SIDE 1 OUT. Then, press the **RX/SELECT** switch to put the receiver on SIDE 2 IN.

5. **Status LEDs**

   These LEDs should illuminate: T1 Pulses, Pattern Sync, Frame Sync, and B8ZS (if applicable).

6. **RESTART switch**

   Press to clear the results and start the test.

7. **RESULTS II Category and Results switches**

   Select SIGNAL category. Scroll RX LEVEL (dBdsx) into the RESULTS II display. The typical signal levels for each location are listed in Table 3.

**RX LEVEL**
**-20 dBdsx**

Table 3
Typical Signal Level Test Locations

| LocationSignal Level | Description | |
|---|---|---|
| Mid-span repeater Input (SIDE1/SIDE2 IN) | -20 dBdsx to -28 dBdsx | Input signal range for regeneration. |
| level after | Output | 0 dBdsx Output signal (SIDE1/SIDE2 OUT) regeneration. |
| DSX-1 monitor jack | -20 dBdsx | Signal level expected after 430 ohm isolation resistors. |
| Distribution frame | -15 dBdsx | Signal level needed when circuit is looped for regeneration at first repeater. |
| NIU | -15 dBdsx | Signal energy needed when circuit is looped for regeneration at last repeater. |
| CSU | -15 dBdsx | Signal energy needed when circuit is looped for regeneration at last repeater. |

8. **RESULTS verification**

   Compare the RX LEVEL result with the expected value in Table 3 for the mid-span repeater. If the signal level is not within specifications at the input to the repeater, the problem is in the direction of the loop and further sectionalization is required.

9. **Status LEDs verification**

   Verify a hard loop has been established at the central office by confirming that the following Status LEDs are illuminated: T1 Pulses, Pattern Sync, Frame Sync, and B8ZS (if applicable).

10. **Circuit disconnect**

    Remove the T-BERD T1 Repeater Adaptor from the repeater housing, remove the repeater from the T-BERD T1 Repeater Adaptor, replace the repeater in the repeater housing, and disconnect the Repeater Adaptor cable from the T1 REPEATER PORT.

## 7. CSU Emulation

- Verify the span installation.
- Terminate the T1 line and loop simplex current.
- Measure simplex current and T1 level
- Auto-respond to T1 loop codes.
- Functionally replace a CSU.

1. **Apply power to the T-BERD 209*OSP***
   Press the **Power** switch on the connector panel. Observe that instrument start up is satisfactory.

2. **Configure the T-BERD 209*OSP* switches:**

| | |
|---|---|
| **MODE** | AUTO. |
| **TIMED TEST** | Continuous (LED extinguished). |
| **RECV'D** | Select recovered timing (LED ON). |
| **RECEIVE INPUT** | TERM. |
| **LBO (dB)** | 0 dB. |
| **AUX RESPONSE** | AUTO RESPONSE. |
| **AUX LOOPCODE** | CSU, IN BAND (typical) or CSU, ESF LINE, if appropriate. |

3. **Disconnect the CSU**
   Upon determining that power has been removed from the span line, disconnect the CSU from the span line at the NIU.

   WARNING **HIGH VOLTAGE MAY BE ENCOUNTERED.**

4. **Span line connection**
   Connect the span line to the T-BERD 209*OSP* using an RJ48 to RJ48 cable (see Figure 6). Install a manual loop at the DSX.

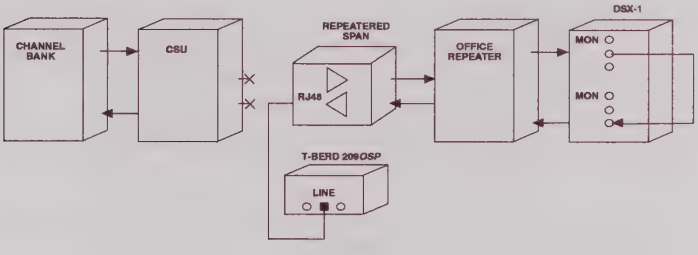



Figure 6
CSU Emulation Setup

5. **Restore power to the span line**

6. **Status LEDs verification**
   These LEDs should illuminate: T1 Pulses, Pattern Sync, Frame Sync, and B8ZS (if applicable).

7. **RESTART switch**
   Press to begin the test.

8. **RESULTS I and II switches**
   Select the SIGNAL category RX LEVEL result in the RESULTS I display and the SPX CURRENT result in the RESULTS II display.

| RX LEVEL | SPX CURRENT |
|---|---|
| -15.1 dBdsx | 60 mA |

9. **LBO (dB) switch**

   Set the line build-out in accordance with the following guidelines:

   - If the RX LEVEL result is -15 dBdsx or below, set the transmit level to 0 dB.
   - If the receive level is -14 to -8 dBdsx, set the transmit level to -7.5 dB.
   - If the receive level is -7.5 dBdsx or above, set the transmit level to -15 dB.

10. **RESULTS I switches**

    Select the SUMMARY category. If errors are not detected, *ALL RESULTS OK* appears. If errors are detected, observe the RESULTS I display for specific errors. Check the other categories as required.

**ALL RESULTS**
**OK**

11. **Results interpretation**

    **VIOLATIONS only**

    These errors typically indicate a local T1 span problem caused by a bad splice, water on the cable, crosstalk, or defective DSX jacks.

    **FRM ERRORS (CRC ERRORS if ESF framing)**

    These errors typically indicate a span line problem between you and the last piece of transmission equipment that framed the signal.

**VIOLATIONS and FRM ERRORS (CRC ERRORS if ESF framing)**

These errors typically indicate a local T1 span problem caused by a bad splice, water on the cable, crosstalk, or defective DSX jacks.

**RX FREQ, Hz**

The DS1 received frequency should be 1.544 MHz ±77 Hz. If the frequency is out-of-specification, check the transmission equipment timing or the network synchronization.

**RX LEVEL (dBdsx)**

The received level should be -20 dBdsx ±3.5 dBdsx at resistor isolated DSX-1 MON jacks. Incorrect levels could be caused by a faulty T1 line card or poor cabling between the DSX jack and the equipment.

**Yellow Alarm LED**

This alarm LED indicates a problem in the transmission leg of the span.

**SPX CURRENT**

If simplex current is not 60 mA, the span should be checked for shorts, opens, and grounds.

12. **Circuit disconnect**

Once you have completed the in-service monitoring, remove the cable from the NIU RJ-48 jack and turn off the instrument.

## 8. Measuring T1 Timing Slips

- Confirm that all the network equipment is properly synchronized.
- Identify frequency deviations which cause uncontrolled and controlled clock slips.
- Isolate possible timing problems.

1. **Configure the T-BERD 209*OSP* switches:**

| | |
|---|---|
| **POWER** | ON. |
| **MODE** | AUTO. |
| **TIMED TEST** | Continuous (LED extinguished). |
| **RECV'D** | Select recovered timing (LED ON). |
| **RECEIVE INPUT** | DSX-MON. |
| **RESULTS I Category** | SUMMARY. |

2. **T1 REF connection**
   Using a WECO 310 cable, connect the T1 timing reference to the T1 REF jack (see Figure 7). The T1 REF input accepts full DSX signals (OUT jack) or DSX-MON signals (monitor jack).

3. **T1 circuit connection**
   Connect a cable from the RECEIVE jack to the span-side (EAST) DSX-1 MON jack (see Figure 7).

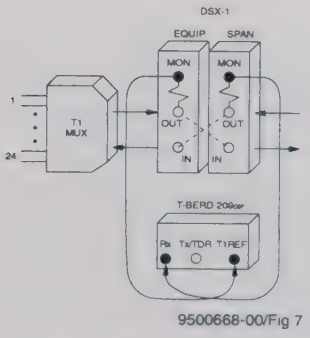



Figure 7
Measuring T1 Timing Slips

4. **RESTART switch**

   Press to clear any spurious alarms and test results that may have been caused by the connection to the T1 circuit.

5. **Status LEDs**

   These LEDs should illuminate: T1 Pulses, Frame Sync, and B8ZS (if applicable).

6. **RESULTS II Category and Results switches**

   Select the SIGNAL category TIMING SLIP result in the RESULTS II display.

**TIMING SLIP**
**003FRM 102BIT**

7. **Results interpretation**

   The result appears in the format *###FRM ###BIT*, where *###* is a number from -999 to 999 for frame slips (FRM) and from -192 to 192 for bit slips (BIT):

   - If the T1 REF and RECEIVER signals are perfectly synchronized, the timing slip count remains at zero.
   - Timing slips verify misoptioned equipment at the customer premises. The customer premises CSU should be set to recovered timing, not internal timing.
   - If the T1 REF and RECEIVER signals are synchronized but one signal contains wander, the timing slip count may increase and decrease through zero.

## 9. Repeater Testing
### *T-BERD T1 Repeater Adaptor Required*

- Use T-BERD T1 Repeater Adaptor to check each side of a repeater for proper operation.

- Provide independent PASS/FAIL results for each side of the repeater.

1. **Apply power to the T-BERD 209*OSP***
   Press the **Power** switch on the connector panel. Observe that instrument start up is satisfactory.

2. **T1 repeater removal**
   Remove the selected repeater from the repeater housing unit.

   CAUTION: Removing the repeater will disable the selected T1 span line.

3. **T1 repeater insertion**
   Insert the repeater into the T-BERD T1 Repeater Adaptor slot.

4. **T1 REPEATER PORT connection**
   Connect the T-BERD T1 Repeater Adaptor cable to the T1 REPEATER PORT on the T-BERD 209*OSP*.

5. **MODE switch**
   Select the REPEATER operating mode.

6. **RESTART switch**
   Press to start the repeater test.

7. **RESULTS displays**
   Observe that *SIDE 1* appears in the RESULTS I display top line, while *TESTING* appears on the second line. When the Side 1 test is complete, observe the test result of either *PASS* or *FAIL* on the second line.

| REPEATER | SIDE 1 | SIDE 2 |
|---|---|---|
| | TESTING | UNAVAILABLE |

Observe that *SIDE 2* appears in the RESULTS II display top line, while *TESTING* appears on the second line. When the Side 2 test is complete, observe the test result of either *PASS* or *FAIL* on the second line and that *COMPLETE* appears in the PATTERN display.

| REPEATER | SIDE 1 | SIDE 2 |
|---|---|---|
| COMPLETE | PASS | FAIL |

8. **Printout generation**

   If a hard copy record of the test results is desired, connect a printer to the T-BERD 209*OSP* and produce printouts in accordance with *Basic Setups, Procedure 2*.

9. **Circuit disconnect**

   Remove the repeater from the T-BERD T1 Repeater Adaptor, replace the repeater in the repeater housing, and disconnect the Repeater Adaptor cable from the T1 REPEATER PORT.

## 10. AUTOTEST

### *T-BERD T1 Repeater Adaptor Required*

- Perform a user-selected series of tests on an out-of-service T1 circuit.
- Provide optional TDR and DC tests of the cable pairs at a mid-span repeater.
- Save time on installation and acceptance testing of a T1 circuit.
- Save time on installation and acceptance testing of a T1 circuit by eliminating the need to change cable connections.
- Record test results for the entire series of tests on one results printout.

1. **Configure the T-BERD 209*OSP* switches:**

| | |
|---|---|
| **POWER** | ON. |
| **MODE** | Select appropriate framing format. |
| **PATTERN** | Select the desired pattern. |
| **B8ZS** | AMI (LED extinguished). |

2. **Mid-span repeater connection**

   When testing at a mid-span repeater housing, unplug the desired repeater from the repeater housing unit and plug the repeater into the T-BERD T1 Repeater Adaptor. Connect the T-BERD T1 Repeater Adaptor cable to the T1 REPEATER PORT connector. Plug the T-BERD T1 Repeater Adaptor into the desired repeater slot.

3. **AUX, PATTERN, and RESULTS switches**

   Select the AUX AUTOTEST function. Select the desired tests to be performed when the **AUTOTEST** switch is pressed.

| | | | |
|---|---|---|---|
| **AUX** | **^TEST^** | **^ON** | **OFF^** |
| **AUTOTEST** | **REPEATER** | **ON** | |

4. **AUX switch**
   Press the **AUX** switch to return to the operating mode (**AUX** switch LED extinguished).

5. **AUTOTEST switch**
   Press to start the automated tests (AUTOTEST switch LED illuminated). The selected tests will be performed.

| | | |
|---|---|---|
| **REPEATER** | **SIDE 1** | **SIDE 2** |
| | **TESTING** | **UNAVAILABLE** |

6. **PATTERN and RESULTS switches**
   Use the **PATTERN** switch to select an automated test that was performed. Use the **RESULTS I Results** switch to scroll through the test results of the automated test selected in the PATTERN display.

7. **Results interpretation**
   Refer to the results interpretation step for the individual tests to interpret the results.

## 11. START UP TESTING OF MULTIPLE T1 LINES

### *T-BERD T1 Repeater Power Supply and Repeater Power Supply Multiplexer Required*

- Enables powering of up to six T1 circuits from the distribution frame in the central office.

1. **Connect transmit cable to the Repeater Power Supply Multiplexer**

   Insert the dual 310 connectors from one end of a dual 310-to-dual 310 cable (model 31442) into the TRANSMIT CURRENT OUT jacks of the T-BERD Repeater Power Supply. Then, connect the dual 310 connectors on the other end of the cable into the TRANSMIT CURRENT OUT jacks of the Repeater Power Supply Multiplexer (see Figure 8).

   WARNING. At this point, **DO NOT** apply power to the T BERD Repeater Power Supply. When the T BERD Repeater Power Supply is powered up, there is a potential of 350 VDC across the terminals which could result in serious personal injury.

2. **Connect transmit cable to the Repeater Power Supply Multiplexer**

   Insert the dual 310 connectors from one end of a dual 310-to-dual 310 cable (model 31442) into the RECEIVE CURRENT IN jacks of the T-BERD Repeater Power Supply. Then, connect the dual 310 connectors on the other end of the cable into the RECEIVE CURRENT IN jacks of the Repeater Power Supply Multiplexer (see Figure 8).

3. **Connect the Line 1 through Line 3 transmit and receive cables**

   Using the WECO 303-to-Dual 310 cable, insert the dual 310 connectors from each cable (Line 1, Line 2, and Line 3) into the appropriate TRANSMIT and RECEIVE jacks on the Repeater Power Supply Multiplexer (see Figure 8).

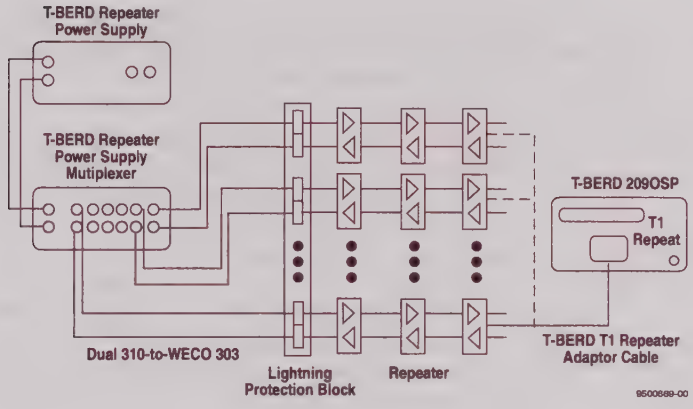



Figure 8
Start Up Testing of Multiple T1 Lines

4. **Connect Line 1 through Line 3 to the CO lightning protection blocks**

   Remove lightning protectors from the CO distribution frame for the three T1 lines to be tested. Using the WECO 303-to-Dual 310 cable, insert transmit and receive cable connectors from the Repeater Power Supply Multiplexer TRANSMIT and RECEIVE jacks into the appropriate sockets vacated by the lightning protectors.

5. **Repeat Steps 3 and 4 for Line 4 through Line 6**

   Repeat the transmit and receive cable connections for Line 4 through Line 6.

6. **Connect the Loopback Connector on the T-BERD Repeater Power Supply**

   Connect the Loopback Connector to the end of the Mainframe Interconnect Cable to provide a hard loop of the signal at the CO.

7. **Connect AC power cord to the T-BERD Repeater Power Supply**
   Connect the AC power cord from the T-BERD Repeater Power Supply to a 120 VAC wall outlet.

   NOTE: If a proper ground connection is not available at the electrical outlet for the AC power cord, connect a wire from an electrical ground connector to the GND connector on the Repeater Power Supply Multiplexer to safely ground the chassis.

   WARNING: Ensure that the **POWER** switch is in the OFF position before connecting the AC Power Cord to the wall outlet. Failure to do so could result in serious personal injury.

8. **Select the appropriate current (60 mA, or 140 mA)**
   Select the appropriate current using the **60 mA, 100 mA, 140 mA** switch on the T-BERD Repeater Power Supply. The appropriate current is determined by the type of repeater in the T-Carrier circuit under test. The typical selection is 60 mA.

9. **Apply power to the T-BERD Repeater Power Supply**
   Ensure the appropriate current is selected and all transmit and receive cables are connected to the Repeater Power Supply Multiplexer and the CO distribution frame. Press the **POWER** switch to ON.

10. **Verify startup**
    When power is applied to the T-BERD Repeater Power Supply, the red High Voltage LED flashes. This indicates that current is passing through the T-BERD Repeater Power Supply.

11. **Verify Circuit path**

When the current path is completed through the circuit, the red High Voltage LED illuminates continuously, and the VOLTAGE and CURRENT displays show current and voltage measurements. If the VOLTAGE and CURRENT displays show the expected current and voltage values, the current path is established.

If the red High Voltage LED flaches continuously, the current path cannot be completed, suggesting there may be an open circuit or other type of wiring fault.

NOTE: If transmit and receive connections are reversed, the measured oltage will be much less than expected.

# DC TESTING

DC Testing

DC TESTING

## 12. DC Testing

***DC Measurements Option Required***

- Measures the voltage potential between two cable pairs.
- Measures the simplex current flowing through the tip and ring pair.
- Measures the resistances from tip-ring, tip-ground, and ring-ground.
- Provides indications of partial opens, shorts, water in the cable, and other cable faults.

NOTE: For any test location for which you desire a printout, you must press both **PRINT** switches (**CONTROLS** and **RESULTS)** prior to pressing the **RX/SELECT** switch, **TX/SELECT** switch, or any major switch, except the **PATTERN** switch. Failure to do so will result in loss of the test results, because of the test restart that occurs when one of these switches is pressed.

1. **Apply power to the T-BERD 209*OSP***

   Press the **Power** switch on the connector panel. Observe that instrument start up is satisfactory.

2. **Mid-span repeater connection**

   When testing at a mid-span repeater housing (see Figure 9), unplug the desired repeater from the repeater housing unit and plug the repeater into the T-BERD T1 Repeater Adaptor. Connect the T-BERD T1 Repeater Adaptor cable to the T1 REPEATER PORT connector. Plug the T-BERD T1 Repeater Adaptor into the desired repeater slot.

   CAUTION: Removing the repeater will disable the selected T1 span line.

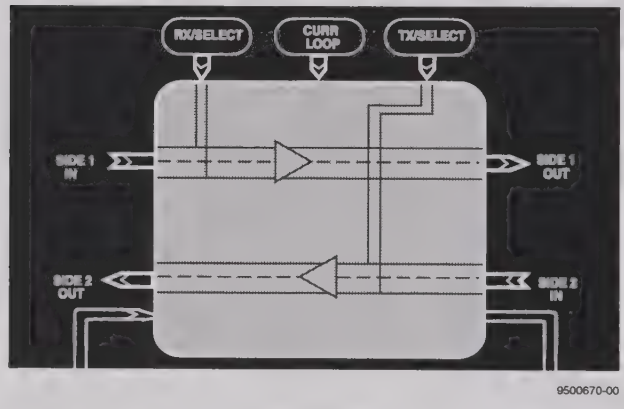



Figure 9
DC Voltage Test Graphic Display

3. **MODE switch**
   Set to DC TEST.

### *Voltage Measurement*

4. **PATTERN switch**
   Select VOLTS.

5. **RX/SELECT switch**
   Press to assign the receiver to SIDE 1 OUT.

6. **TX/SELECT switch**
   Press to assign the transmitter to SIDE 1 IN.

7. **VOLTS results verification**
   The RESULTS I display shows the position of the transmitter and the value of the voltage potential between the transmitter and receiver (### VDC). The RESULTS II display shows the position of the receiver. For instance, a test from *SIDE 1 IN* (transmitter) to *SIDE 1 OUT* (receiver) measures the voltage potential across the top half of the repeater (see the graphic display configuration to confirm the test location). Verify the voltage is within the expected range.

| DC TEST | SIDE 1 IN | SIDE 1 OUT |
|---|---|---|
| VOLTS | 7.4 VDC | |

### *Simplex Current Measurement*

8. **PATTERN switch**
   Select AMPS.

9. **CURRENT results verification**
   The RESULTS I display shows *SPX CURRENT* as the heading and *## + ## = ## mA* directly underneath the heading, where the first *##* is the tip current, the second *##* is the ring current, and the final *##* is the total simplex current.

   Verify the tip current equals the ring current (balanced circuit). Then, verify the sum of the tip and ring currents equals the total simplex current. Finally, verify the total current value matches the office repeater settings and falls within the expected range.

| DC TEST | SPX CURRENT |
|---|---|
| AMPS | 30 + 30 = 60 mA |

### *DC Resistance Measurements*

10. **PATTERN switch**
    Select OHMS.

11. **Downstream repeater setup**

Have a second technician open the repeater housing for the next repeater on the span. Establish two-way communications with the second technician. Prior to measuring the Tip-Ground and Ring-Ground resistances have the technician remove the repeater for the same T1 circuit and connect the appropriate conductor to ground (Tip or Ring).

12. **OHMS results verification**

Set the RESULTS I display to show *TX RNG-GND* as the heading. Set the RESULTS II display to show *TX TIP-GND* as the heading. Observe the resistances. Verify these values are within the expected range and they are approximately the same (balanced T1 circuit).

| DC TEST | TX RNG-GND | TX TIP-GND |
|---|---|---|
| OHMS | 155 Ohm | 155 Ohm |

13. **RESULTS I Results switch**

Prior to measuring the Tip-Ring resistance, have the technician at the downstream repeater housing connect the Tip and Ring conductors together. Set the RESULTS I display to show *TX Tip-RING* and observe the resistance. Verify the Tip-Ring resistance is approximately equal to the sum of the Tip-Ground and Ring-Ground resistances.

| DC TEST | TX TIP-RNG | TX TIP-GND |
|---|---|---|
| OHMS | 310 Ohm | >10 MOhm |

14. **PRINT switches**
    Press the **CONTROLS** and **RESULTS** switches to get a hard copy of the test results for *SIDE 1 IN*, if desired.

### *Changing Test Location to Side 1 Out*

15. **PATTERN switch**
    Select VOLTS.

16. **RX/SELECT switch**
    Press to assign the receiver to SIDE 2 IN.

17. **TX/SELECT switch**
    Press to assign the transmitter to SIDE 1 OUT.

18. **Repeat for SIDE 1 OUT**
    Repeat Steps 7 through 13 for SIDE 1 OUT.

### *Changing Test Location to Side 2 In*

19. **PATTERN switch**
    Select VOLTS.

20. **RX/SELECT switch**
    Press to assign the receiver to SIDE 2 OUT.

21. **TX/SELECT switch**
    Press to assign the transmitter to SIDE 2 IN.

22. **Repeat for SIDE 2 IN**
    Repeat Steps 7 through 13 for SIDE 2 IN.

### *Changing Test Location to Side 2 Out*

23. **PATTERN switch**
    Select VOLTS.

24. **RX/SELECT switch**
    Press to assign the receiver to SIDE 1 IN.

25. **TX/SELECT switch**
    Press to assign the transmitter to SIDE 2 OUT.

26. **Repeat for SIDE 2 OUT**
    Repeat Steps 7 through 13 for SIDE 2 OUT.

### *Test Complete*

27. **Circuit disconnect**
    Once you have completed testing, remove the T-BERD T1 Repeater Adaptor from the repeater housing, remove the repeater from the T-BERD T1 Repeater Adaptor, replace the repeater in the repeater housing, and disconnect the Repeater Adaptor cable from the T1 REPEATER PORT.

28. **Downstream repeater setup**
    Have the second technician replace the downstream repeater and close up the repeater housing.

# TDR TESTING

## TDR Testing For Cable Pair Faults

TDR TESTING

## 13. TDR Testing For Cable Pair Faults

***Cable Qualification Option Required***

- Test copper wire cable pairs for shorts, opens, bridge taps, etc.
- Produce TDR trace printouts for comparison with known fault traces.
- Store reference trace for dual trace comparison and analysis.

NOTE: The TDR cannot look past hard opens or shorts. Multiple faults on a cable pair reduce the effectiveness of the TDR. Therefore, as faults are located, repair them and retest the line.

1. **MODE switch**
   Select TDR mode.

2. **PATTERN switch**
   Select TDR SETUP menu.

3. **RESULTS I Category switch**
   Select CABLE type and PR. VEL for the cable pair being tested (see Table 4).

Table 4
Selectable Cable Types

| Cable Type | Propagation Velocity | Description |
|---|---|---|
| PIC/22<br>PIC/24<br>PIC/26 | .67<br>.66<br>.65 | 22 to 26 gauge PIC (polyethylene insulated cable) wire. |
| JELL/22<br>JELL/24<br>JELL/26 | .62<br>.61<br>.60 | 22 to 26 gauge jelly-filled insulated wire. |
| PULP/22<br>PULP/24<br>PULP/26 | .71<br>.70<br>.68 | 22 to 26 gauge paper-pulp insulated wire. |
| USER/22<br>USER/24<br>USER/26 | .40 - .99 | When the wire gauge and Vp are known<br>for a cable type not listed, select the wire gauge with the **RESULTS I Results** switch and the PR. VEL in 0.01 steps with the **RESULTS I Category** switch. |
| DEFAULT | .66 | If PR. VEL and CABLE are unknown, select DEFAULT to set the Vp at 0.66. |

4. **RESULTS II Results switch**
   Select LENGTH: 1000, 3000, or 6500 feet.

5. **RESULTS II Category switch**
   Press to set to *NO REF* (if not already *NO REF*) to clear reference trace buffer.

6. **TDR connection**
   When testing at a mid-span repeater housing (see Figure 10), unplug the desired repeater from the repeater housing unit and plug the repeater into the T-BERD T1 Repeater Adaptor. Connect the T-BERD T1 Repeater Adaptor cable to the T1 REPEATER PORT connector. Plug the T-BERD T1 Repeater Adaptor into the desired repeater slot.

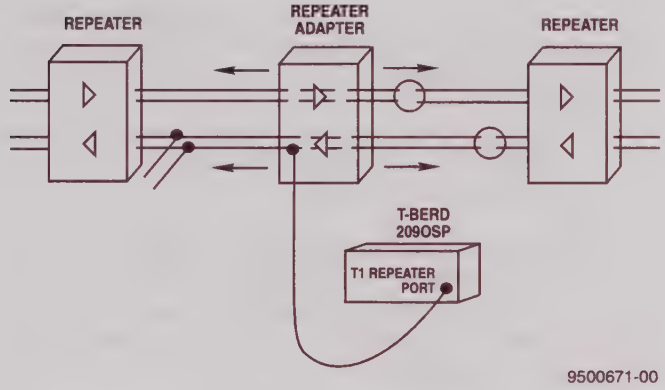



Figure 10
TDR Testing from a Mid-Span Repeater

7. **TX/SELECT switch**
   Press to select the cable pair to test first.

8. **RESTART switch**
   Press to start TDR test.

9. **Test verification**

   - *TESTING* flashes in PATTERN window.
   - *RESULTS: NOT AVAILABLE* appears in the RESULTS I display and the graphic display.
   - When test is complete, fault and distance information appears in the RESULTS I display, and a TDR trace appears in the graphic display. Up to four faults can be identified.

10. **Cable pair fault analysis**
    The RESULTS I display presents the TDR test results in one of the following formats:

    NOTE: The selected CABLE type must match the cable being tested to obtain accurate results.

If *FLT 1-1: OPEN/AT #### FEET* appears where *#### FEET* is the expected distance to the end of the cable pair, the pair is good. No further testing is required.

If *FAULT: NONE* appears, no fault is detected. Either the cable pair is too long to be fully tested or it is terminated with no impedance change.

If *FLT 1-1: OPEN/AT or SHORT/AT #### FEET* appears where *#### FEET* is less than the expected distance to the end of the cable pair, the pair has a short or open at the indicated distance. The fault must be cleared and the procedure repeated.

If *FLT 1-#: B-TAP/AT #### FEET* appears, the pair has a bridge tap at indicated distance and another fault(s) at a further distance. Each fault must be identified and cleared. Then the procedure should be repeated.

If *FLT 1-#: UNREC/AT #### FEET* appears, look at the graphic display and compare the fault deflection to known fault traces, check the SETUP menu to verify the cable parameters are correct (an open on a PIC/24 cable may be an unrecognized fault if PIC/22 is selected), and print the results for later comparison and analysis.

If the TDR is being used on an active T1 circuit with all repeaters installed, the TDR trace will see a short at the next repeater. If the TDR is being used as part of installation testing and the repeaters are not yet installed, the TDR trace will show an open at the next repeater location.

Figure 11 illustrates the TDR trace after the initial test of a cable pair. The TDR trace indicates a bridge tap at 544 feet (position 1) and an open at 1611 feet (position 2).

By selecting Fault 2 from the TDR RESULTS display, the magnified trace of Fault 2, shown in Figure 12, can be more clearly viewed. The trace at Fault 2 has the characteristics of an open.

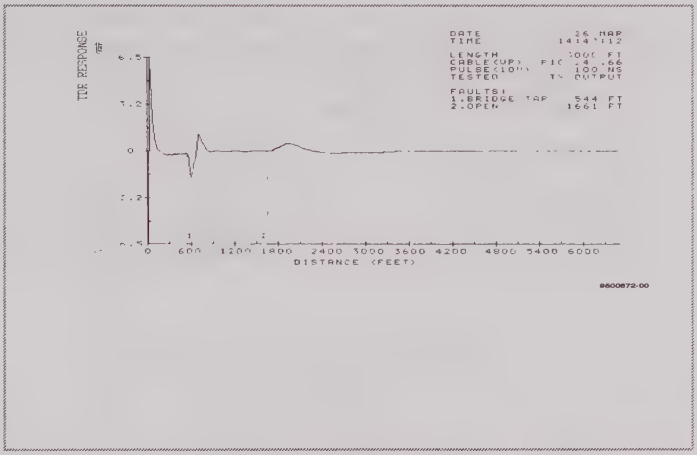



Figure 11
Initial TDR Test Result Display

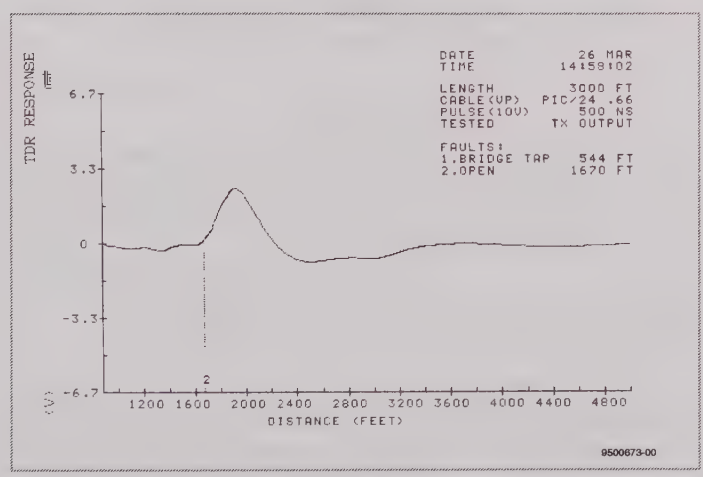



Figure 12
Magnified TDR Display

To verify the actual fault at Fault 2, remove the bridge tap and repeat the TDR test. Figure 13 clearly identifies the fault as an open, and with the bridge tap removed, the open becomes the first fault down the cable pair.

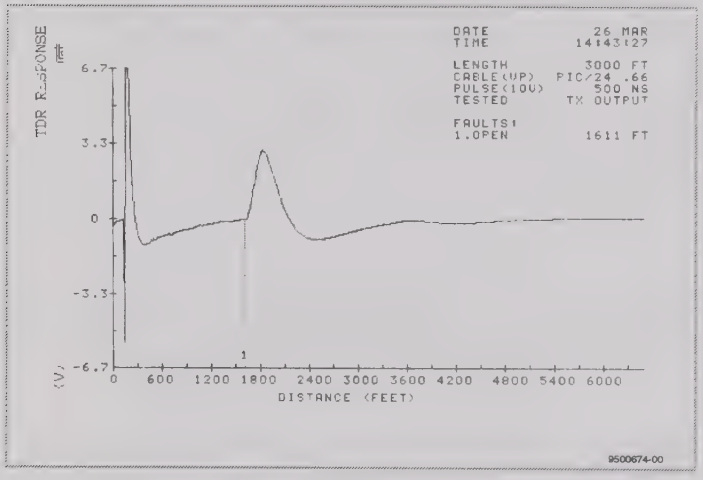



Figure 13
Verifying the Second Cable Pair Fault

11. **Generate a printout (optional)**

Go to Print a Single Trace TDR Graph to print a single trace GRAPH. Go to Print a Dual Trace TDR Graph to print a dual trace GRAPH. Go to Print TDR Results and Setup to print the TDR results and setup printout.

## Print a Single Trace TDR Graph

1. **PATTERN switch**

Select the TDR SETUP menu and verify that *NO REF* is displayed.

2. **PATTERN switch**

Select TDR RESULTS and verify that *PRINT GRAPH* is displayed.

3. **RESULTS II Category switch**
   Press this switch to print a single trace graph (see Figure 14).

Figure 14
Single Trace TDR Printout

## Print a Dual Trace TDR Graph

1. **PATTERN switch**
   Select the TDR SETUP menu and verify that *NO REF* is displayed.

2. **RESULTS II Category switch**
   Press this switch to store the current trace and verify that *REF STORED* appears.

3. **Select another cable pair and press RESTART switch**
   Test the second cable pair. Verify that a TDR dual trace appears in the graphic display. The solid line is the current trace, and the dotted line is the reference trace.

4. **RESULTS II Category switch**
   Press this switch to print a dual trace graph (see Figure 15).

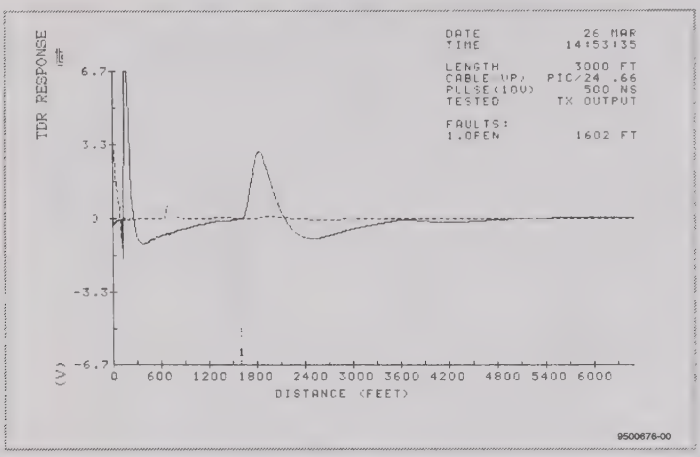



Figure 15
Dual Trace TDR Printout

## Print TDR Results and Setup

1. **PRINT switches**
   Press the **RESULTS** switch to print the TDR results, or press the **CONTROLS** switch to print the TDR setup configuration (see Figure 16).

```
TDR CONTROLS PRINT    08:27:50      28 FEB
   SETTINGS:
     LENGTH (FT)      3000
     CABLE  (VP)      PIC/24
     REFERENCE        NO


TDR RESULTS PRINT     08:28:27      28 FEB
  FAULTS:
1. B-TAP at    544 feet
2. OPEN  at    1611 feet
```

Figure 16
TDR Controls and Results Printouts

# ADVANCED TESTING

Monitoring DS0 and Signaling Bits

Testing Fractional T1 Networks

Remote Testing With Performance Monitoring NIUs

Testing Spans With Intelligent Repeaters

ADVANCED TESTING

## 14. Monitoring DS0 and Signaling Bits

***Advanced Services Support Option Required***

- Display signaling and data bits of a user-selected DS0 channel.
- Monitor a DS0 channel.

1. **Configure the T-BERD 209*OSP* switches:**

| | |
|---|---|
| **POWER** | ON. |
| **MODE** | AUTO. |
| **TIMED TEST** | Continuous (LED extinguished). |
| **RECV'D** | Select recovered timing (LED ON). |
| **RECEIVE INPUT** | DSX-MON. |
| **RESULTS I Category** | SUMMARY. |

2. **T1 circuit connection**

   Connect a cable from the RECEIVE jack to the DSX-1 MON jack (see Figure 17).

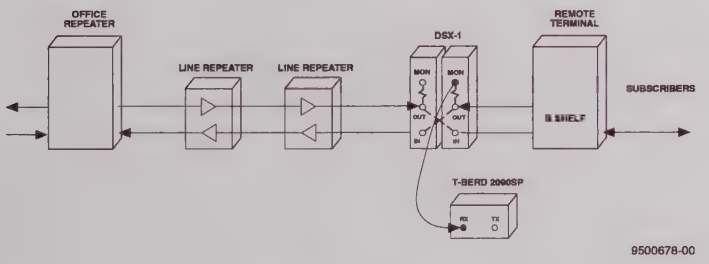



Figure 17
DS0 Channel Monitor Setup

3. **RESTART switch**

   Press to clear any spurious alarms that may have occurred during T1 circuit connection.

4. **Signal verification**

   These LEDs should illuminate: T1 Pulses, Pattern Sync, Frame Sync, and B8ZS (if applicable).

5. **RESULTS I switches**

   If errors are not detected, *ALL RESULTS OK* appears. If errors are detected, observe the RESULTS I display for specific errors. Check the other categories as required.

   **ALL RESULTS**
   **OK**

6. **AUX, PATTERN, and RESULTS 1 Results switches**

   Select the AUX VF CHAN function and select the channel to be dropped.

| | | |
|---|---|---|
| **AUX** | **NEXT^** | **PREV$_v$** |
| **VF CHAN** | **CHANNEL** | **01** |

7. **RESULTS I switches**

Select the SIGNAL category. Select the TRAFFIC result. The TRAFFIC display verifies proper handshaking between the transmission equipment for off hook, on hook, and ring sequences (see Appendix B Trunk Type Summary). For T1 D1D, T1 D4, and T1 SLC framing, only A and B signaling bits are displayed.

| | | |
|---|---|---|
| **T1 D4** | **A000000 111111** | **000000 111111** |
| **TRAFFIC** | **B111111 000000** | **111111 000000** |

For T1 ESF framing, A, B, C, and D signaling bits are displayed.

| | | |
|---|---|---|
| | **a 000000 111111** | **000000 111111** |
| **T1 ESF** | **b111111 000000** | **111111 000000** |
| **TRAFFIC** | **c 000000 111111** | **000000 111111** |
| | **d111111 000000** | **111111 000000** |

8. **RESULTS I Results switch**

Press this switch to select the DATA BITS result for the AUX VF CHAN channel selection. The data bits for the selected channel are displayed in the corresponding RESULTS I display. The DATA BITS display shows sampled data from the selected timeslot.

| | |
|---|---|
| **T1 D4** | **DATA BITS** |
| **3 IN 24** | **CH 03 11001010** |

9. **TX/SELECT and RX/SELECT switches**

When the T-BERD T1 Repeater Adaptor is not connected, and the AUX VF CHAN function has been set to a channel, the graphics display will show the channel, data bits, and signaling bits for the selected channel. Pressing either the **TX/SELECT** switch or **RX/SELECT** switch will increase or decrease the channel number and automatically update the AUX VF CHAN function.

10. **Circuit disconnect**

Once you have completed the test, remove the cable from the DSX-1 MON jack and turn off the instrument.

## 15. Testing Fractional T1 Networks

***Fractional T1 Option Required***

- Conduct out-of-service testing of FT1 network.
- Confirm that the contiguous or non-contiguous FT1 signal is properly received by the network equipment.

1. **Configure the T-BERD 209*OSP*:**

| | |
|---|---|
| **POWER** | ON. |
| **MODE** | Select appropriate T1 framing format. |
| **PATTERN** | Select desired test pattern. |
| **B8ZS** | B8ZS (LED ON), if appropriate. |
| **TIMED TEST** | Continuous (LED extinguished). |
| **RECV'D** | Select internal timing (LED extinguished). |
| **RECEIVE INPUT** | TERM. |
| **LBO** | 0 dB. |
| **LOOP CODES** | CSU. |
| **AUX RESPONSE** | NO RESPONSE. |
| **AUX LOOPCODE** | CSU — IN-BAND, ESF LINE, or ESF PAYLOAD, as appropriate. |

3. **T1 circuit connection**

Connect a cable from the RECEIVE jack to the DSX-1 OUT jack. Connect a cable from the TRANSMIT/TDR jack to the DSX-1 IN jack (see Figure 18).

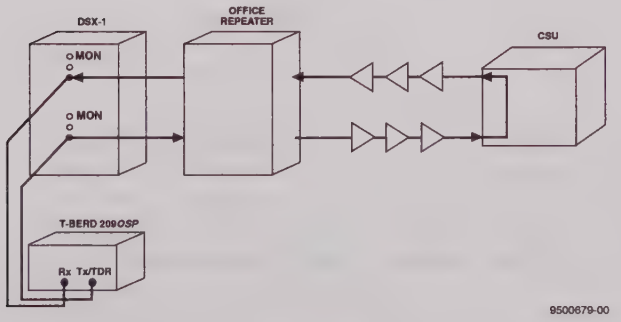



Figure 18
FT1 Out-of-Service Testing From a DSX-1 Patch Panel

4. **RESTART switch**
   Press to clear any spurious alarms than may have occurred during T1 circuit connection.

5. **LOOP CODES and LOOP UP switches**
   Press the **LOOP UP** switch to send the selected loop-up code. Observe the switch LED illuminates and remains illuminated until the loopback is established (approximately seven seconds for in-band loop codes).

6. **Status LEDs**
   These LEDs should illuminate: T1 Pulses, Pattern Sync, Frame Sync, and B8ZS (if applicable).

7. **RESULTS I Category switch**
   Select the SUMMARY category.

8. **ERR INS switch and RESULTS I display**
   Press this switch five times to verify that the logic errors and BPVs are received and the T1 circuit is looped back.

   NOTE: If the loopback is not established, the bit errors do not appear in the display. The failed loopback could be because the NIU/CSU is not operating correctly, the line from the instrument to the NIU/CSU is bad, or the transmitted loop code is incorrect.

**BIT ERRORS**
**5**

9. **RESTART switch**
   Press to clear the results and start the test.

### *Fractional T1 Test Setup*

1. **Configure the T-BERD 209*OSP* switches:**

   | | |
   |---|---|
   | **MODE** | FT1 D4 or FT1 ESF. |
   | **PATTERN** | Select desired FT1 test pattern (63, 511, 2047). |

2. **AUX switch**
   Press to illuminate the LED.

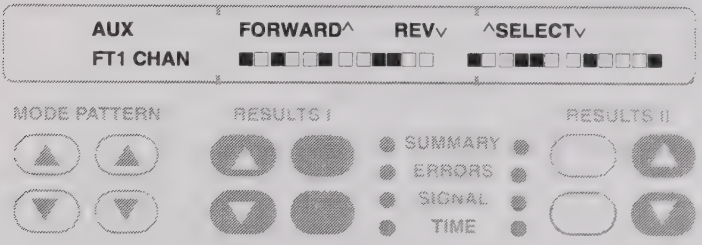
3. **PATTERN and RESULTS switches**
   Select the AUX FT1 SETUP function to set the idle code and FT1 channel rate. One bit in the RESULTS I display is flashing to indicate it is in edit mode. To select a different bit to be edited, press the **RESULTS I Results** switch up arrow to move to the right or down arrow to move to the left. Pressing the **RESULTS I Category** switch up or down arrow, changes the flashing bit to a one or zero, respectively, and automatically advances one bit to the right.

   Pressing the **RESULTS II Results** switch up or down arrow toggles between the 56KxN and 64KxN channel rates.

| AUX | FOR/REV | 1/0 | CHAN RATE |
|---|---|---|---|
| FT1 SETUP | IDLE: | 11111111 | 56K x N |

Press the **PATTERN** switch to select the AUX FT1 CHAN function, which enables selection of the FT1 channel bandwidth. Filled boxes indicate the corresponding channel is part of the bandwidth. One of the boxes flashes to indicate it is in the edit mode. Pressing the **RESULTS I Results** switch up arrow moves the flashing from left to right. Pressing the **RESULTS I Results** switch down arrow moves the flashing from right to left. Pressing either arrow after it has reached the end of its range wraps around to the beginning.

Pressing the **RESULTS II Results** switch up arrow selects the flashing channel and advances the cursor one channel to the right. Pressing the **RESULTS I Results** switch down arrow deselects the flashing channel and moves the cursor one channel to the right.




4. **AUX switch**
   Press to extinguish the LED.

5. **Press the RESTART switch**

### *Fractional T1 Results*

1. **Results interpretation**

   **VIOLATIONS only**
   These errors typically indicate a local T1 span problem caused by a bad splice, crosstalk, water on the cable, or defective DSX jacks.

   **FRM ERRORS (CRC ERRORS if ESF framing)**
   These errors typically indicate the problem is between you and the last piece of transmission equipment that framed the signal. BPVs are corrected by most transmission equipment.

   **RX FREQ, Hz**
   The DS1 received frequency should be 1.544 MHz ±77 Hz. If the frequency is out-of-specification, check the transmission equipment timing or the network synchronization.

**RX LEVEL (dBdsx)**
The received level should be -20 dBdsx ±3.5 dBdsx at resistor isolated DSX-1 MON jacks. Incorrect levels could be caused by a faulty T1 line card or poor cabling between the DSX jack and the equipment.

**Yellow Alarm LED**
The far end sends a Yellow Alarm to indicate that it is not receiving a T1 signal. This alarm indicates that the transmission leg is bad.

### *Test Disconnect*

1. **MODE switch**
   Select the appropriate T1 framing format.

2. **LOOP DOWN switch**
   Press the **LOOP DOWN** switch to deactivate the loopback.

3. **Circuit disconnect**
   Remove the cable from the DSX-1 OUT jack and DSX-1 IN jack. Then, remove the cables from the RECEIVE and TRANSMIT/TDR jacks.

## 16. Remote Testing with Performance Monitoring NIUs
### *Enhanced ESF Option Required*

- Query a Westell NIU/Performance Monitor for ESF Circuit performance history.

1. **Configure the T-BERD 209*OSP* switches:**

| | |
|---|---|
| **POWER** | ON. |
| **MODE** | SMARTNIU. |
| **PATTERN** | RESULTS. |
| **B8ZS** | B8ZS (LED ON), if appropriate. |
| **TIMED TEST** | Continuous (LED extinguished). |
| **RECV'D** | Select internal timing (LED extinguished). |
| **RECEIVE INPUT** | TERM. |
| **LBO** | 0 dB. |

2. **Connect the T-BERD 209*OSP* to the T1 circuit**
   Connect a cable from the RECEIVE jack to the span-side (EAST) DSX-1 OUT jack. Connect a cable from the TRANSMIT/TDR jack to the span-side (EAST) DSX-1 IN jack (see Figure 19).

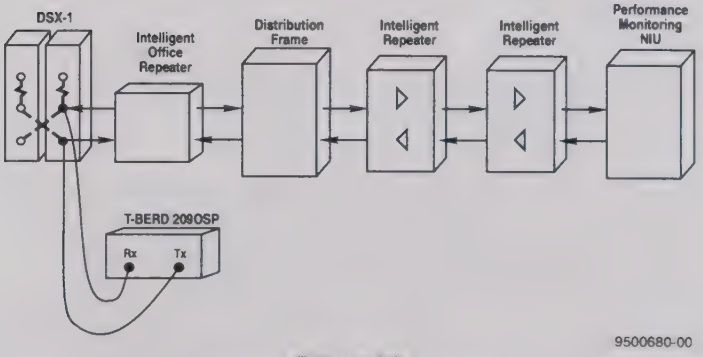



Figure 19
Smart NIU Testing Setup

3. **Press the RESTART switch to activate the Query function**
   Activating the Query function automatically transmits the NIU loop code to loopback the NIU, before transmitting the data retrieval codes.

4. **Monitor retrieval process**
   Observe the RESULTS display and verify the Query function is proceeding satisfactorily. The message *QUERY IN PROGRESS* alternates with the PIR results in the RESULTS I display.

   NOTE: Some NIU/Performance Monitor equipment may not provide PIR results. If PIR results are not provided by the NIU/Performance Monitor, only the *QUERY IN PROGRESS* message is displayed.

| | | | | |
|---|---|---|---|---|
| **SMARTNIU** | **100** | **PIR** | **94** | **12 OF 793** |
| **RESULTS** | **93** | **AZ/ZA** | **97** | **RECEIVED** |

5. **Results interpretation**
   Observe the RESULTS display and verify the Query function is completed.

| | | |
|---|---|---|
| **SMARTNIU** | **QUERY** | **ERRORS** |
| **RESULTS** | **COMPLETE** | **DETECTED** |

| | | | |
|---|---|---|---|
| **SMARTNIU** | **100** | **PIR** | **94** |
| **RESULTS** | **93** | **AZ/ZA** | **97** |

6. **Printout the SMARTNIU Report**
   Press the **PRINT** switch to printout the SMARTNIU Report.

7. **Disconnect the T-BERD 209*OSP* from the span**

## 17. Testing Spans With Intelligent Repeaters
***Smart Loopback/Command Codes Option Required***

- Sectionalize intelligent repeater spans by transmitting appropriate loop codes from the central office.

1. **Configure the T-BERD 209*OSP* switches:**

| | |
|---|---|
| **POWER** | ON. |
| **MODE** | Select appropriate T1 framing (intelligent repeater loop-up and loop-down codes must be sent in a framed T1 signal). |
| **PATTERN** | Select the appropriate test pattern. |
| **B8ZS** | B8ZS (LED ON), if appropriate. |
| **TIMED TEST** | Continuous (LED extinguished). |
| **RECV'D** | Select internal timing (LED extinguished). |
| **RECEIVE INPUT** | TERM. |
| **LBO** | 0 dB. |
| **LOOP CODES** | PROG. |

2. **AUX and PATTERN switches**
   Press the **AUX** switch to illuminate the LED. Press the **PATTERN** switch to select the AUX SMARTNET function.

3. **RESULTS switches**
   Press the **RESULTS I Results** switch to select the intelligent network equipment type (IOR, ILR, MSWITCH).

   Press the **RESULTS II Category** switch to select the equipment manufacturer (TELTREND, WESCOM, WESTELL, etc.).

   Press the **RESULTS II Results** switch to select the equipment model (7231, FIELD, NIMS-20, etc.).

   NOTE: Once an equipment manufacturer and model is selected, it remains in memory and does not have to be reset until the test set is used with a span that has a different model for the same manufacturer.

| AUX | | TELTREND |
|---|---|---|
| SMARTNET | ILR | 7231 LD |

4. **PATTERN switch**
   Select the AUX LOOPCODE function.

5. **Select the loop code(s)**
   Some intelligent network equipment requires an arming code before it will respond to loop codes, press the **RESULTS I Category** switch to select ILR CMD. Press the **RESULTS II Results** switch to determine if the ARM/DISARM command is available. If ARM/DISARM does not appear, go to the *Intelligent Repeater Span Sectionalization* procedure. If ARM/DISARM does appear, perform the following steps.

| AUX | ^SELECT v | | ^COMMAND v |
|---|---|---|---|
| LOOPCODE | PROG | ILR CMD | ARM/DISARM |

2. **AUX switch**
   Press to extinguish the LED.

3. **Connect the T-BERD 209*OSP* to the T1 circuit**
   Connect a cable from the RECEIVE jack to the span-side (EAST) DSX-1 OUT jack. Connect a cable from the TRANSMIT/TDR jack to the span-side (EAST) DSX-1 IN jack (see Figure 20).

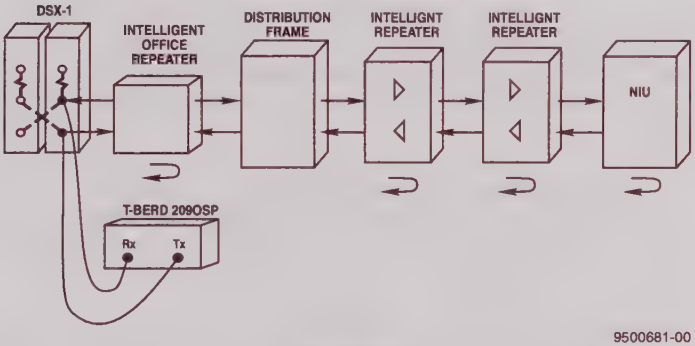



Figure 20
Testing Intelligent Repeater Spans

8. **LOOP UP switch**

   Press this switch to send the arming/NIU loop-up code. The switch LED illuminates for six seconds. This arms the span's intelligent repeaters and provides a loopback at the NIU.

9. **Press the RESTART switch to clear spurious alarms**

10. **Status LEDs**

    When the NIU loopback is established, these LEDs should illuminate: T1 Pulses, Pattern Sync, Frame Sync, and B8ZS (if applicable).

11. **CATEGORY and RESULTS switches**

    Check the SUMMARY category. If errors are not detected, *ALL RESULTS OK* appears, and no further testing of the span is necessary. Go to the *Disconnect the T-BERD 209OSP* procedure.

    If errors are detected, scroll through the SUMMARY category for specific errors. Check the other categories as required. Record the types of errors to determine the symptoms of the span problem.

12. **Symptoms identification**

**VIOLATIONS only**

These errors typically indicate a local T1 span problem caused by a bad splice, water on the cable, crosstalk, or defective DSX jacks.

**FRM ERRORS (CRC ERRORS if ESF framing)**

These errors typically indicate a span line problem between you and the last piece of transmission equipment that framed the signal.

**VIOLATIONS and FRM ERRORS (CRC ERRORS if ESF framing)**

These errors typically indicate a local T1 span problem caused by a bad splice, water on the cable, crosstalk, or defective DSX jacks.

**RX FREQ, Hz**

The DS1 received frequency should be 1.544 MHz ±77 Hz. If the frequency is out-of-specification, check the transmission equipment timing or the network synchronization.

**RX LEVEL (dBdsx)**

The received level should be -20 dBdsx ±3.5 dBdsx at resistor isolated DSX-1 MON jacks. Incorrect levels could be caused by a faulty T1 line card or poor cabling between the DSX jack and the equipment.

**Yellow Alarm LED**

This alarm LED indicates a problem in the transmission leg of the span.

***AIS LED***

An Alarm Indication Signal (AIS) indicates equipment in the signal path is not receiving the T1 signal from the far end.

## *Intelligent Repeater Span Sectionalization*

**AUX and PATTERN switches**

Press the **AUX** switch to illuminate the LED. Press the **PATTERN** switch to select the AUX LOOPCODE (PROG) function.

2. **CATEGORY and RESULTS switches**

   Press the **RESULTS I Category** switch to select ILR. Press the **RESULTS II Results** switch to set the address for the mid-span repeater.

| AUX | ^SELECTv | | ^ADDRESSv |
|---|---|---|---|
| LOOPCODE | PROG | ILR | 12 |

3. **AUX switch**

   Press to extinguish the LED.

4. **LOOP UP switch**

   Press this switch to send the intelligent repeater loop-up code to the mid-span repeater. The switch LED illuminates while the loop code is being transmitted. This should loop back the signal at the addressed intelligent repeater. In some cases, the loop code transmission times out after six seconds without waiting for a confirmation signal from the addressed repeater.

   If the switch LED remains illuminated, the span problem may be preventing the loop code from reaching the addressed intelligent repeater or from returning to the T-BERD 209*OSP*. Go to Step 8 and select a repeater closer to the CO.

5. **Status LEDs verification**

   These LEDs should illuminate: T1 Pulses, Pattern Sync, Frame Sync, and B8ZS (if applicable).

   NOTE: If testing will take longer than 30 minutes, you need to activate the timeout disable feature. Select the AUX LOOPCODE (PROG) function, press the **RESULTS I Category** switch to select ILR CMD, and press the **RESULTS II Results** switch to select TIMEOUT DISABLE. Exit the auxiliary functions and press the **LOOP UP** switch to send the loop code that disables the automatic timeout feature.

6. **Results interpretation**

   Check the SUMMARY category. If the identified symptoms are detected, the problem is between the Central Office (CO) and the looped-back mid-span repeater.

   If the T-BERD 209*OSP* was unable to loop back the signal at the addressed repeater, the span problem is probably between the CO and the addressed repeater. The span problem could be blocking the loop codes.

   If the message *ALL RESULTS OK* is displayed and no Alarm LEDs are illuminated, the problem is between the looped-back mid-span repeater and the customer premises.

7. **LOOP DOWN switch**

   Press this switch to send the intelligent repeater loop-down code to the mid-span repeater.

8. **Determine new intelligent repeater address**

   Select a new intelligent repeater to be looped back based on the results in Step 6.

9. **AUX, PATTERN, CATEGORY, and RESULTS switches**

   Select the AUX LOOPCODE (PROG) function. Set the ILR address to match the selected intelligent repeater.

| AUX | | ^SELECTv | ^ADDRESSv |
|---|---|---|---|
| LOOPCODE | PROG | ILR | 11 |

10. **AUX switch**

    Press to extinguish the LED.

11. **LOOP UP switch**

Press this switch to send the intelligent repeater loop-up code to the selected repeater. The switch LED illuminates while the loop code is being transmitted. In some cases, the loop code transmission times out after six seconds without waiting for a confirmation signal from the addressed repeater.

If the T-BERD 209*OSP* was unable to loop back the signal at the addressed repeater, the span problem is probably between the CO and the addressed repeater. The span problem could be blocking the loop codes. Return to Step 7.

12. **Results interpretation**

If the looped-back repeater is closer to the CO and errors are still detected, the problem is between the Central Office (CO) and the looped-back repeater. If the looped-back repeater is closer to the CO and no errors are detected, the problem is between the two looped-back repeaters.

If the looped-back repeater is closer to the customer premises and errors are detected, the problem is between the two looped-back repeaters. If the looped-back repeater is closer to the customer premises and no errors are detected, the problem is between the looped-back repeater and the customer premises.

13. **Repeat steps until problem is isolated**

Repeat Steps 7 through 12 until the problem's location has been isolated between two or three repeaters. Now the problem's exact location can be determined by accessing only one or two repeater housings.

14. **LOOP DOWN switch**

Press this switch to loop down the intelligent repeater.

### *Disconnect the T-BERD 209OSP*

1. **AUX, PATTERN, and RESULTS switches**
   Select AUX LOOPCODE (PROG) to set the appropriate arming/disarming code.

| AUX | ^SELECT> | | ^COMMAND> |
|---|---|---|---|
| LOOPCODE | PROG | ILR CMD | ARM/DISARM |

2. **AUX switch**
   Exit the auxiliary function.

3. **LOOP DOWN switch**
   Press this switch to send the disarming/NIU loop-down code. The switch LED illuminates for six seconds.

4. **Disconnect the T-BERD 209OSP from the span.**

# HDSL TESTING

Verifying Cable Length

Measuring Loss

Measuring Signal Power

HTU Loopback Testing

HDSL TESTING

## 18. Verifying Cable Length

***HDSL Measurements Option Required***

- Measure total cable length, including bridge taps.
- Measure total cable capacitance.

1. **MODE switch**
   Select HDSL mode.

2. **PATTERN switch**
   Select LOOP LEN test.

3. **RESULTS I Results switch**
   Select appropriate CABLE TYPE (PIC 19-26, PULP 19, PULP 22, PULP 24, PULP 26, or DEFAULT).

4. **HDSL cable connection**
   Disconnect each cable pair at the HTU-R, so that only the cable length is being tested. Connect a cable from the TRANSMIT/ TDR jack to the cable pair at the HTU-C (see Figure 21).

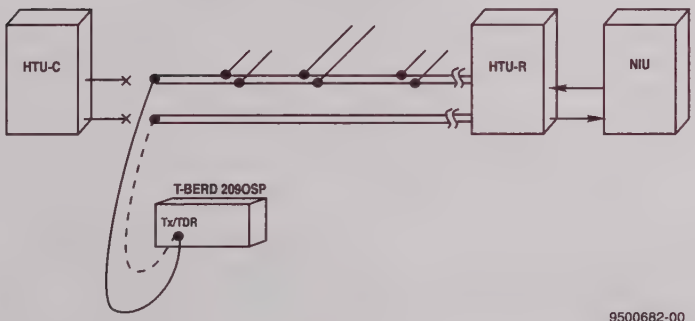



Figure 21
Measuring HDSL Circuit Cable Length

5. **RESTART switch**

   Press to clear previous results and start the test.

6. **Test verification**

   - *LOOP LENGTH UNAVAILABLE* appears in the RESULTS II display.

   - When test is complete, a value in feet (e.g., *15000 Ft*) appears in the RESULTS II display under LOOP LENGTH.

7. **RESULTS II Results switch**

   Press to toggle between LOOP LENGTH and LOOP CAP (total loop capacitance in picofarads).

## 19. Measuring Loss

***HDSL Measurements Option Required***

- End-to-end testing that requires two T-BERD 209*OSP*s.
- Measure Signal Loss on an HDSL circuit.

1. **MODE switch**
   Select HDSL mode.

2. **PATTERN switch**
   Select 196KHz test.

3. **HDSL near-end cable connection**
   Connect a cable from the TRANSMIT/TDR jack of the near-end unit to the LINE 1 cable pair. Connect a cable from the RECEIVE jack of the near-end unit to the LINE 2 cable pair. See Figure 22.

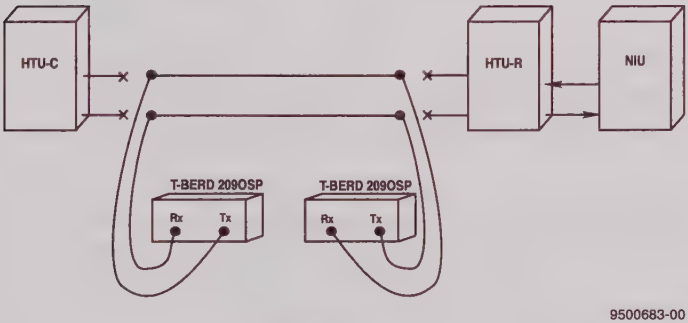



Figure 22
Measuring HDSL Circuit Signal Loss

4. **HDSL far-end cable connection**
   Connect a cable from the RECEIVE jack of the far-end unit to the LINE 1 cable pair. Connect a cable from the TRANSMIT/TDR jack of the far-end unit to the LINE 2 cable pair. See Figure 22.

5. **Test results**
   The near-end T-BERD 209*OSP* displays the LINE 2 LOSS (in dB) in the RESULTS I display. The far-end T-BERD 209*OSP* displays the LINE 1 LOSS (in dB) in the RESULTS I display.

## 20. Measuring Signal Power
### *HDSL Measurements Option Required*

- Measure Signal Power on an active HDSL circuit.

1. **MODE switch**
   Select HDSL mode.

2. **PATTERN switch**
   Select POWER test.

3. **RECEIVE INPUT switch**
   Select BRIDGE.

4. **HDSL cable connection**
   Connect a cable from the RECEIVE jack to the LINE 1 cable pair (see Figure 23).

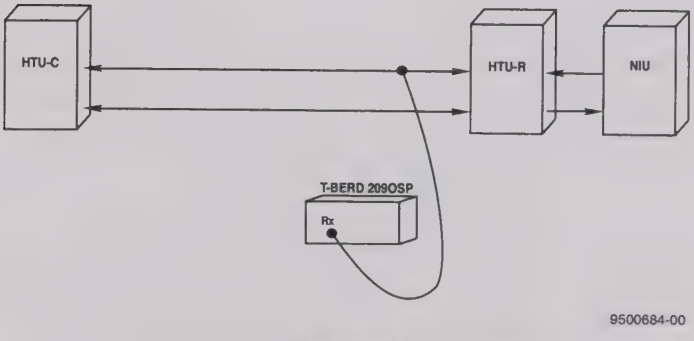



Figure 23
Measuring HDSL Circuit Signal Power

5. **Test results**
   The RESULTS I display shows the POWER result (in dBm) for LINE 1.

## 21. HTU Loopback Testing

***HDSL Measurements or Smart Loopback/ Command Codes Option Required***

- Sectionalize HDSL span by transmitting appropriate loop codes from the central office.

1. **Configure the T-BERD 209*OSP* switches:**

| | |
|---|---|
| **POWER** | ON |
| **MODE** | Select appropriate T1 framing |
| **PATTERN** | Select the appropriate test pattern |
| **B8ZS** | B8ZS (LED ON), if appropriate |
| **TIMED TEST** | Continuous (LED extinguished) |
| **RECV'D** | Select internal timing (LED extinguished) |
| **RECEIVE INPUT** | TERM |
| **LBO** | 0 dB |

2. **AUX and PATTERN switches**
   Press the **AUX** switch to illuminate the LED. Press the **PATTERN** switch to select the AUX LOOPCODE function.

3. **RESULTS switches**
   Press the **RESULTS I Results** switch to select PROG. Press the **RESULTS I Category** switch to select HDSL. Press the **RESULTS II Results** switch to select HTU-R.

| | | | |
|---|---|---|---|
| **AUX** | | **^SELECTv** | **^SELECTv** |
| **LOOPCODE** | **PROG** | **HDSL** | **HTU-R** |

4. **AUX switch**

   Press to extinguish the LED.

5. **Connect the T-BERD 209*OSP* to the T1 circuit**

   Connect a cable from the RECEIVE jack to the span-side (EAST) DSX-1 OUT jack. Connect a cable from the TRANSMIT/TDR jack to the span-side (EAST) DSX-1 IN jack (see Figure 24).

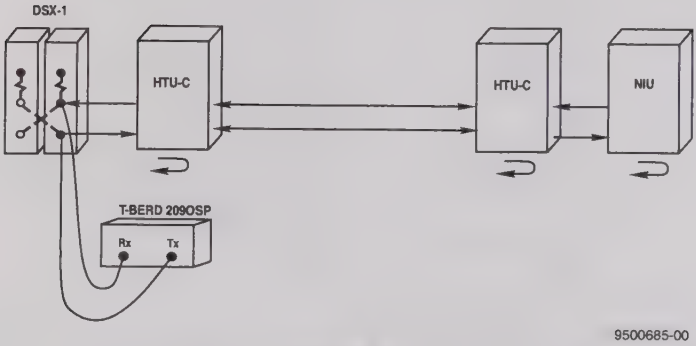



Figure 24
Testing HDSL Equipment Spans

6. **LOOP UP switch**

   Press this switch to send the HDSL remote unit loop-up code. The switch LED illuminates until the loop code is detected. This loops back the signal at the HDSL remote unit.

   If the switch LED remains illuminated, the span problem may be preventing the loop code from reaching the HDSL remote unit or from returning to the T-BERD 209*OSP*. Go to Step 11.

7. **Press the RESTART switch to clear spurious alarms**

8. **Status LEDs verification**

   When the HTU-R loopback is established, these LEDs should illuminate: T1 Pulses, Pattern Sync, Frame Sync, and B8ZS (if applicable).

9. **Results interpretation**

Check the SUMMARY category. If the message *ALL RESULTS OK* is displayed and no Alarm LEDs are illuminated, the problem is between the looped-back HDSL remote unit and the customer premises.

If span errors are detected, the problem is between the Central Office (CO) and the looped-back HDSL remote unit. Go to Step 10.

If the T-BERD 209*OSP* was unable to loop back the signal at the HTU-R, the span problem is probably between the CO and the HDSL remote unit. The span problem could be blocking the loop codes. Go to Step 11.

10. **Symptoms identification**

**VIOLATIONS only**

These errors typically indicate a local T1 span problem caused by a bad splice, water on the cable, crosstalk, or defective DSX jacks.

**FRM ERRORS (CRC ERRORS if ESF framing)**

These errors typically indicate a span line problem between you and the last piece of transmission equipment that framed the signal.

**VIOLATIONS and FRM ERRORS (CRC ERRORS if ESF framing)**

These errors typically indicate a local T1 span problem caused by a bad splice, water on the cable, crosstalk, or defective DSX jacks.

**RX FREQ, Hz**

The DS1 received frequency should be 1.544 MHz ±77 Hz. If the frequency is out-of-specification, check the transmission equipment timing or the network synchronization.

**RX LEVEL (dBdsx)**

The received level should be -20 dBdsx ±3.5 dBdsx at resistor isolated DSX-1 MON jacks. Incorrect levels could be caused by a faulty T1 line card or poor cabling between the DSX jack and the equipment.

**Yellow Alarm LED**
This alarm LED indicates a problem in the transmission leg of the span.

***AIS LED***
An Alarm Indication Signal (AIS) indicates equipment in the signal path is not receiving the T1 signal from the far end.

11. **LOOP DOWN switch**
Press this switch to send the HDSL remote unit loop-down code.

12. **AUX, PATTERN, CATEGORY, and RESULTS switches**
Select the AUX LOOPCODE (PROG) function. Press the **RESULTS II Results** switch to select HTU-C.

| | | | |
|---|---|---|---|
| **AUX LOOPCODE** | **PROG** | **^SELECTv HDSL** | **^SELECTv HTU-C** |

13. **AUX switch**
Press to extinguish the LED.

14. **LOOP UP switch**
Press this switch to send the HDSL office unit loop-up code. The switch LED illuminates until the loop code is detected.

If the T-BERD 209*OSP* was unable to loop back the signal at the HDSL office unit, the span problem is probably between the CO and the HDSL office unit. The span problem could be blocking the loop codes. Troubleshoot the line between the DSX-1 and the HTU-C.

15. **Results interpretation**

    If errors are still detected, the problem is between the Central Office (CO) and the HTU-C.

    If no errors are detected, the problem is between the HTU-C and the HTU-R. Use the HDSL mode tests to identify the problem.

16. **LOOP DOWN switch**

    Press this switch to loop down the HDSL office unit.

### *Disconnect the T-BERD 209OSP*

1. **Disconnect the T-BERD 209*OSP* from the span.**

# TESTING DIGITAL LOOP CARRIER (DLC) NETWORKS

Monitoring DLC Shelf Performance

In-Service Remote Terminal Alarm Verification

Verify Ring Generation and Circuit Continuity

Verify Channel Signaling and VF Continuity

In-Service Shelf Bit Error Rate Testing

Checking SLC Mode II Timeslot Assignments

# TESTING DIGITAL LOOP CARRIER (DLC) NETWORKS

## 22. Monitoring DLC Shelf Performance

***DLC Analyzer Option Required***

- Perform long-term non-intrusive monitoring of the DLC shelf channel and datalink performance.
- Monitor the datalink traffic between the Central Office Switch (COS) or Central Office Terminal (COT) and the Remote Terminal (RT) for major, minor, and power/miscellaneous alarms, as well as switch to protect and automated maintenance test requests.
- Monitor DS0 channels in both directions for channel signaling and capturing DTMF dialed digits.

Figure 25 illustrates the DLC Analyzer Option monitoring the DLC Shelf A T1 channels and datalink from the DSX-1 access point.

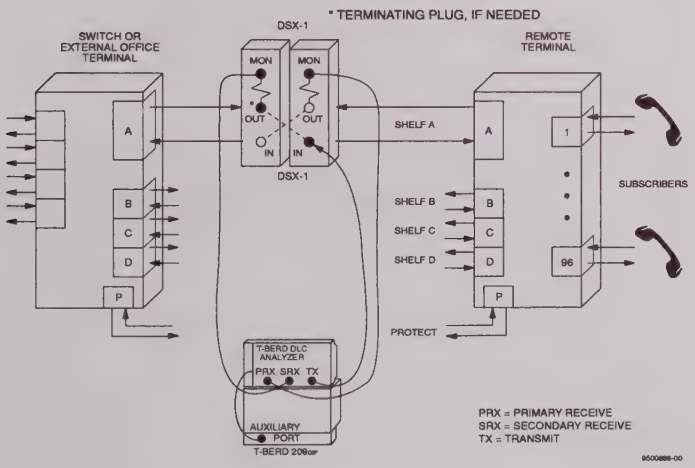



Figure 25
Monitoring DLC Shelf Performance

### *T-BERD 209OSP Mainframe Test Setup*

1. **Connect DLC Analyzer Option cable**
   Connect this cable to the T-BERD 209*OSP* AUXILIARY PORT connector. The T-BERD 209*OSP* only provides power to the DLC Analyzer Option.

   NOTE: If operating on battery power, turn off the T-BERD 209*OSP* before connecting the cable from the DLC Analyzer Option. This conserves battery power for increased operating time.

### *DLC Analyzer Option Test Setup*

2. **AUX, FRAME, and FORMAT switches**
   Set the CHANNEL VF DROP auxiliary function to set which T1 line the DS0 channel is dropped from; PRIMARY, SECONDARY, or BOTH.

| | |
|---|---|
| **CHANNEL** | ↑ **select** ↓ |
| **VF DROP** | **BOTH** |

Set the CHANNEL SCROLL auxiliary function to either BOTH to scroll the **PRIMARY** and **SECONDARY CHANNEL** switches scroll together, or SEPARATE to allow them to scroll channel numbers separately.

| | |
|---|---|
| **CHANNEL** | **↑ select ↓** |
| **CHANNEL SCROLL** | **BOTH** |

3. **AUX switch**
   Exit the auxiliary functions.

4. **FRAME switch**
   Select AUTO mode.

5. **B8ZS switch**
   Select the appropriate coding (AMI or B8ZS).

6. **RECEIVE INPUT switch and PRIMARY RECEIVE jack**
   Select the DSX-MON input level. Connect a cable between this jack and the T1 line as follows:

   - If at the CO, plug a cable between this jack and the Shelf A equipment-side DSX-1 MON jack.
   - If at the RT, plug a cable between this jack and the Shelf A span-side DSX-1 MON jack.

7. **SECONDARY RECEIVE jack**
   Connect a cable between this jack and the T1 line as follows:

   - If at the CO, plug a cable between this jack and the Shelf A span-side DSX-1 MON jack.
   - If at the RT, plug a cable between this jack and the Shelf A equipment-side DSX-1 MON jack.

8. **FRAME/FORMAT window**

Verify that the framing format is detected and recognized.

NOTE: When synchronizing to the SLC-96 framing in AUTO mode, the T-BERD DLC Analyzer Option automatically defaults to the SLC-M1 mode. The SLC-M2 mode must be selected manually with the **FRAME** switch.

9. **RESTART switch**

Clear the results and start the test.

10. **Status LEDs**

These LEDs should illuminate: T1 Pulses, Frame Sync, and B8ZS (if applicable). The Alarms LED may illuminate.

11. **RESULTS I test results**

If errors or alarms are not detected, *ALL RESULTS OK* appears. If errors or alarms are detected, scroll through the SUMMARY category for specific errors or alarms. Check each category as required.

**ALL RESULTS**
**OK**

12. **DLC results interpretation**

***Flashing Messages — P/S DATALINK SYNC LOSS, and P/S SIGNAL LOSS***

These messages occur when the DLC Analyzer Option loses datalink synchronization or T1 signal. These messages only appear in the SUMMARY category.

***Alarm Messages — P/S FE LOOP PROTECT, P/S FE LOOP SHELF x, P/S MAJOR ALM, P/S MAJOR SHELF x, P/S ALARM SHELF x, P/S MINOR ALM, P/S PWR/MISC, P/S SHELF x ON PROT***

These alarms provide information on the condition of the shelves. These messages also appear in the DATALINK category as a historical record of the indicated events.

***Maintenance Test Messages — P/S MAINT HOOK/SEIZE, P/S MAINT PROCEED, P/S MAINT TEST ALARM***

These messages indicate the associated maintenance test condition is detected. These messages also appear in the DATALINK category as a historical record of the indicated events.

13. **T1 signal results interpretation**

***T1 Signal Error Results — P/S VIOLATION, P/S FRM ERROR, and P/S CRC ERROR (ESF framing only)***

These errors typically indicate a local T1 span problem caused by a faulty repeater, span line noise, crosstalk, poor cabling, or defective DSX jacks. Electrical noise, generated near the metallic span can also contribute to errors received at the instrument. These messages only appear in the SUMMARY category.

***P/S FRM ERROR***

This error typically indicates a near-end span line problem caused by a faulty multiplexer. Sectionalize the facility further downstream.

14. **PRIMARY CHANNEL or SECONDARY CHANNEL switch**

Press either switch to select a DS0 channel. If the CHANNEL/CHANNEL SCROLLING auxiliary function is set to BOTH, the channels numbers are scrolled simultaneously. If the CHANNEL/CHANNEL SCROLLING auxiliary function is set to SEPARATE, the channels numbers are scrolled separately (see CHANNEL/CHANNEL SCROLLING auxiliary function).

15. **DS0 channel results interpretation**

***P/S VF LEVEL, P/S VF FREQ, P/S DATA BITS, and DTMF SEQ***

Verify that the VF signal level and frequency are within specifications on the selected line. Verify that a data bit is not stuck. Monitor the DTMF dialing sequences.

NOTE: The VF LEVEL and VF FREQ test results are only valid when the CHANNEL VF DROP auxiliary function is set to either PRIMARY or SECONDARY.

***P/S TRAFFIC CHANNEL ABCD, P/S TRAFFIC TIMESLOT, and P/S TS CHAN***

For all framing formats except SLC-M2, monitor the traffic signaling bits. For the SLC-M2 framing format, monitor the timeslot traffic and the timeslot channel assignments originating from the central office terminal (only valid source of SLC-M2 timeslot channel assignments).

16. **VF OUT jack**

Connect a TIMS test set to the VF OUT jack (4-wire, 600Ω, VF jack) to perform additional testing and analysis on the selected DS0 channel.

## 23. In-Service Remote Terminal Alarm Verification
### *DLC Analyzer Option Required*

- Verify the alarm, switch to protection, and far-end loop response capabilities of the RT.
- Verify the automated maintenance test procedure function of the Mode 1 SLC-96 RT.

Figure 26 illustrates the DLC Analyzer Option testing the RT from the DSX-1 access point.

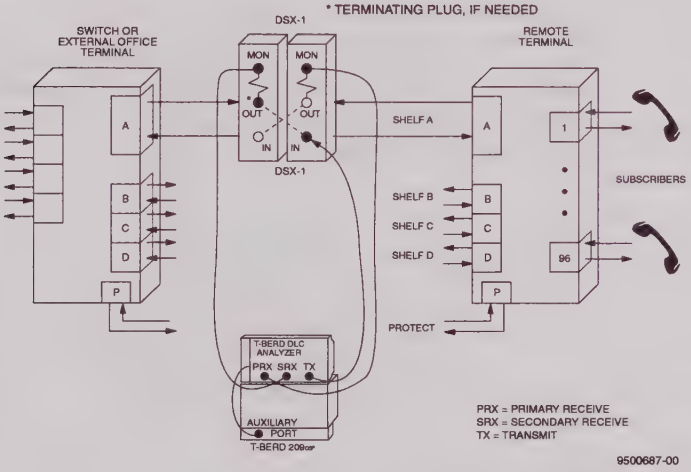



Figure 26
In-Service Remote Terminal Alarm Verification

### *T-BERD 209OSP Mainframe Test Setup*

1. **Connect DLC Analyzer Option cable**
   Connect this cable to the T-BERD 209*OSP* AUXILIARY PORT connector.

   NOTE: If operating on battery power, turn off the T-BERD 209*OSP* before connecting the cable from the DLC Analyzer Option. This conserves battery power for increased operating time.

### *DLC Analyzer Option Test Setup*

2. **AUX switch**
   Set the following auxiliary functions as follows:

| | |
|---|---|
| **CHANNEL** | **↑ select ↓** |
| **VF DROP** | **BOTH** |

Set the CHANNEL SCROLL auxiliary function to either BOTH to scroll the **PRIMARY** and **SECONDARY CHANNEL** switches together, or SEPARATE to allow them to scroll channel numbers separately.

| | |
|---|---|
| **CHANNEL** | **↑ select ↓** |
| **CHANNEL SCROLL** | **BOTH** |

| | |
|---|---|
| **TRANSMIT** | **↑ select ↓** |
| **LBO** | **0 dB** |

NOTE If testing from the CO to the RT, set the LBO to 0 dB. If testing at the RT, set the LBO to -15 dB.

3. **AUX switch**
   Exit auxiliary functions.

4. **FRAME switch**
   Select SLC-M1 or SLC-M2 mode as appropriate.

5. **FORMAT switch**
   Select DATLINK format.

6. **B8ZS switch**
   Select the appropriate coding (AMI or B8ZS).

7. **RECEIVE INPUT switch and PRIMARY RECEIVE jack**
   Select the DSX-MON input level. Connect a cable between this jack and the T1 line as follows:

   - If at the CO, plug a cable between this jack and the Shelf A span-side DSX-1 MON jack.

   - If at the RT, plug a cable between this jack and the Shelf A equipment-side DSX-1 MON jack.

8. **SECONDARY RECEIVE jack**
   Connect a cable between this jack and the T1 line as follows:

   - If at the CO, plug a cable between this jack and the Shelf A equipment-side DSX-1 MON jack.

   - If at the RT, plug a cable between this jack and the Shelf A span-side DSX-1 MON jack.

9. **TRANSMIT jack**

   Plug the cable into the DLC Analyzer Option first, then plug the cable in as follows:

   - If at the CO, plug a cable between this jack and the Shelf A span-side DSX-1 IN jack.
   - If at the RT, plug a cable between this jack and the Shelf A equipment-side DSX-1 IN jack.
   - If the DSX-1 MON jack is not properly terminated, install a 100-ohm terminating plug in the DSX-1 OUT jack as shown in Figure 25.

   NOTE: You may notice a brief service interruption when you plug the cable into the DSX-1 IN jack.

10. **RESTART switch**

    Clear the results and start the test.

11. **Status LEDs**

    Both primary and secondary LEDs should illuminate: T1 Pulses, Frame Sync, and B8ZS (if applicable). The Alarms LED may illuminate.

12. **RESULTS I test results**

    If errors or alarms are not detected, *ALL RESULTS OK* appears. If errors or alarms are detected, scroll through the SUMMARY category for specific errors or alarms. Check each category as required.

**ALL RESULTS**
**OK**

13. **SOURCE I and II switches**
Select one of the following alarms and shelves:

| | | | |
|---|---|---|---|
| **SOURCE I** | MAJOR | MINOR | PWR/MISC |
| **SOURCE II** | SHELF A<br>SHELF B<br>SHELF C<br>SHELF D<br>NO SHELF | N/A | N/A |

14. **INSERT switch**
Press this switch to insert and send the selected alarm to the RT. The switch LED illuminates while in the insert mode.

15. **Datalink results interpretation**
***Alarm Messages — P/S MAJOR ALM, P/S MAJOR SHELF x, P/S ALARM SHELF x, P/S MINOR ALM, and P/S PWR/MISC***
These alarms should be indicated at the RT.

16. **INSERT switch**
Press this switch to stop sending the alarm to the RT. The switch LED goes out.

17. **SOURCE I and II switches**
Select either the far-end loopback or switch to protection command.

| | | |
|---|---|---|
| **SOURCE I** | FE LOOP | SW PROT |
| **SOURCE II** | SHELF B*<br>SHELF C<br>SHELF D*<br>PROTECT | SHELF B*<br>SHELF C<br>SHELF D* |

* Not available in SLC-M2 operating mode.

18. **INSERT switch**
Press this switch to insert and send the selected command to the RT. The switch LED illuminates while in the insert mode.

19. **Datalink results interpretation**

***Alarm Messages — P/S FE LOOP PROTECT, P/S FE LOOP SHELF x, and P/S SHELF x ON PROT***

The SHELF x ON PROT alarm can be verified at the DLC Analyzer Option and the RT. The other alarms can only be verified at the RT or with a BERT test of the line.

20. **INSERT switch**

Press this switch to stop sending the command to the RT. The switch LED goes out.

21. **SOURCE I switch**

Select the MAINT command to establish the automated maintenance test procedure. Ensure that SHELF A is selected.

22. **SECONDARY CHANNEL switch**

Select the desired DS0 channel.

23. **INSERT switch**

Press this switch to insert and send the MAINT command to the RT. The switch LED illuminates while in the insert mode. The maintenance test is performed on the DS0 channel selected in Step 22.

24. **Datalink results interpretation**

***Maintenance Test Messages — S MAINT HOOK/SEIZE, S MAINT PROCEED, S MAINT TEST ALARM***

These messages indicate the associated maintenance test condition is detected. Progress messages appear in lowercase in the SOURCE II display. These progress messages include, *hook/seize, proceed, succeed* , *test alarm* (means no response from the RT), *failed*, (means test alarm form RT. These message also appear in the DATALINK category as a historical record of the indicated events.

NOTE. The DLC Analyzer Option emulates the maintenance test generated from the COT.

### *Disconnect the DLC Analyzer Option*

25. **INSERT switch**
    Press this switch to stop sending the command to the RT. The switch LED goes out.

26. **TRANSMIT jack**
    Remove the 100-ohm terminating plug, if installed. Unplug the cable from the DSX-1 IN jack first. Then unplug the cable from the DLC Analyzer Option.

    NOTE: You may notice a brief service interruption when you unplug the cable from the DSX-1 IN jack.

27. **PRIMARY RECEIVE and SECONDARY RECEIVE jacks**
    Unplug the cables from the DSX-1 MON jacks, then the DLC Analyzer Option.

## 24. Verify Ring Generation and Circuit Continuity
### *DLC Analyzer Option Required*

- Verify the ring generator is functioning at the RT.
- Verify the dial tone is functioning on the selected channel.
- Test one or all 24 channels on a shelf.

Figure 27 illustrates the DLC Analyzer Option testing the RT ring generator and local loops from the DSX-1 access point.

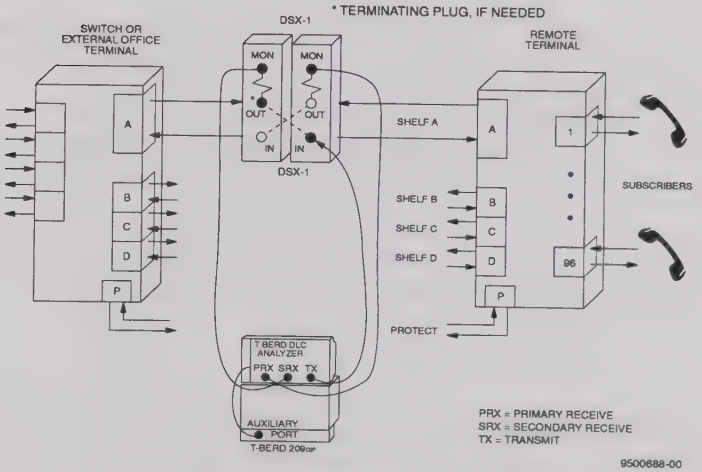



Figure 27
Testing Ring Generators and Local Loops

### *T-BERD 209OSP Mainframe Test Setup*

1. **Connect DLC Analyzer Option cable**
   Connect this cable to the T-BERD 209*OSP* AUXILIARY PORT connector.

   NOTE If operating on battery power, turn off the T-BERD 209*OSP* before connecting the cable from the DLC Analyzer Option. This conserves battery power for increased operating time.

### *DLC Analyzer Option Test Setup*

2. **AUX switch**

Set the following auxiliary functions as follows:

Select the PRIMARY RECEIVE input to monitor the DS0 channels from the RT. Select BOTH receiver inputs when both sides of the line require monitoring.

| **CHANNEL** | **↑ select ↓** |
|---|---|
| **VF DROP** | **PRIMARY** |

Select either loop start or ground start trunk type.

| **CHANNEL** | **↑ select ↓** |
|---|---|
| **TRUNK TYPE** | **LOOP START** |

Set the CHANNEL SCROLL auxiliary function to either BOTH to scroll the **PRIMARY** and **SECONDARY CHANNEL** switches together, or SEPARATE to allow them to scroll channel numbers separately.

| **CHANNEL** | **↑ select ↓** |
|---|---|
| **CHANNEL SCROLL** | **BOTH** |

| | |
|---|---|
| **TRANSMIT** | **↑ select ↓** |
| **LBO** | **0 dB** |

NOTE. If testing from the CO to the RT, set the LBO to 0 dB. If testing at the RT, set the LBO to -15 dB.

Set the MISC VOLUME auxiliary function to mid-range, three to four boxes filled.

| | |
|---|---|
| **MISC** | **↑ UP DOWN ↓** |
| **VOLUME** | ■■■■□□□ |

3. **AUX switch**
   Exit auxiliary functions.

4. **FRAME switch**
   Select SLC-M1 mode.

5. **SECONDARY CHANNEL switch**
   Set this switch to the double dashes ( — — ). This prevents the DLC Analyzer Option from inserting its own channel signaling into a channel.

6. **FORMAT switch**
   Select CHANNEL format.

7. **B8ZS switch**
   Select the appropriate coding (AMI or B8ZS).

8. **RECEIVE INPUT switch and PRIMARY RECEIVE jack**
   Select the DSX-MON input level. Connect a cable between this jack and the T1 line as follows:

   - If at the CO, plug a cable between this jack and the Shelf A span-side DSX-1 MON jack.
   - If at the RT, plug a cable between this jack and the Shelf A equipment-side DSX-1 MON jack.

9. **SECONDARY RECEIVE jack**
   Connect a cable between this jack and the T1 line as follows:

   - If at the CO, plug a cable between this jack and the Shelf A equipment-side DSX-1 MON jack.
   - If at the RT, plug a cable between this jack and the Shelf A span-side DSX-1 MON jack.

10. **TRANSMIT jack**
    Plug the cable into the DLC Analyzer Option first, then plug the cable in as follows:

    - If at the CO, plug a cable between this jack and the Shelf A span-side DSX-1 IN jack.
    - If at the RT, plug a cable between this jack and the Shelf A equipment-side DSX-1 IN jack.
    - If the DSX-1 MON jack is not properly terminated, install a 100-ohm terminating plug in the DSX-1 OUT jack as shown in Figure 26.

    NOTE: You may notice a brief service interruption when you plug the cable into the DSX-1 IN jack.

11. **INSERT switch**
    Press this switch to insert and send the selected command to the RT. The switch LED illuminates while in the insert mode.

12. **RESTART switch**
    Clear the results and start the test.

13. **Status LEDs**

Both primary and secondary LEDs should illuminate: T1 Pulses, Frame Sync, and B8ZS (if applicable). The Alarms LED may illuminate.

14. **RESULTS I test results**

If errors or alarms are not detected, *ALL RESULTS OK* appears. If errors or alarms are detected, scroll through the SUMMARY category for specific errors or alarms. Check each category as required.

**ALL RESULTS**
**OK**

15. **ON HOOK switch**

Press this switch to place the selected channel on hook. Note that a dial tone is not heard from the speaker. The switch LED illuminates while on hook.

16. **SECONDARY CHANNEL switch**

Select the desired DS0 channel. When the channel is selected the DLC Analyzer Option takes control of the channel's signaling.

17. **DS0 channel results interpretation**

***P VF LEVEL, P VF FREQ, P/S DATA BITS, and DTMF SEQ***

Verify that the VF signal level and frequency are within specifications. Verify that a data bit is not stuck. Monitor the DTMF dialing sequences.

NOTE. The VF LEVEL and VF FREQ test results are only valid when the CHANNEL VF DROP auxiliary function is set to either PRIMARY or SECONDARY.

***P TRAFFIC CHANNEL AB, P TRAFFIC CHANNEL ABCD, P TRAFFIC TIMESLOT, and P TS CHAN***

For all framing formats except SLC-M2, monitor the channel signaling bits. For the SLC-M2 framing format, monitor the timeslot traffic and the timeslot channel assignments originating from the central office terminal (only valid source of SLC-M2 timeslot channel assignments).

18. **OFF HOOK switch**

    Press this switch to place channel off hook. Note that a dial tone is heard from the speaker. The switch LED illuminates while in the off-hook state. The **ON HOOK** switch LED goes out and the **ABCD** switches indicate the change.

19. **ON HOOK switch**

    Press this switch to place channel on hook. Note that a dial tone is not heard from the speaker. The switch LED illuminates while in the on-hook state. The **OFF HOOK** switch LED goes out and the **ABCD** switches indicate the change.

20. **OFF HOOK switch**

    Press this switch to place channel off hook. Note that a dial tone is heard from the speaker again. The switch LED illuminates while in the off-hook state. The **ON HOOK** switch LED goes out and the **ABCD** switches indicate the change.

21. **RING switch**

    Press this switch to ring the local subscriber loop. Note that the ring back signal is heard from the speaker. The switch LED illuminates while ringing.

22. **ON HOOK switch**

    Press this switch to place channel on hook. Note that a dial tone is not heard from the speaker. The switch LED illuminates while in the on-hook state.

### *Disconnect the DLC Analyzer Option*

23. **SECONDARY CHANNEL switch**
    Set this switch to the double dashes ( — — ). This prevents the DLC Analyzer Option from inserting its own channel signaling into a channel.

24. **INSERT switch**
    Press this switch to stop sending the command to the RT. The switch LED goes out.

25. **TRANSMIT jack**
    Remove the 100-ohm terminating plug, if installed. Unplug the cable from the DSX-1 IN jack first. Then, unplug the cable from the DLC Analyzer Option.

    NOTE: You may notice a brief service interruption when you unplug the cable from the DSX-1 IN jack.

26. **PRIMARY RECEIVE and SECONDARY RECEIVE jacks**
    Unplug the cables from the DSX-1 MON jacks, then the DLC Analyzer Option.

## 25. Verify Channel Signaling and VF Continuity
### *DLC Analyzer Option and Butt-Set Required*

- Verify ring generator is functioning at the RT.
- Test one or all 24 channels on a shelf.

Figure 28 illustrates the DLC Analyzer Option testing the RT ring generator and local loop DTMF dialing capabilities from the DSX-1 access point.

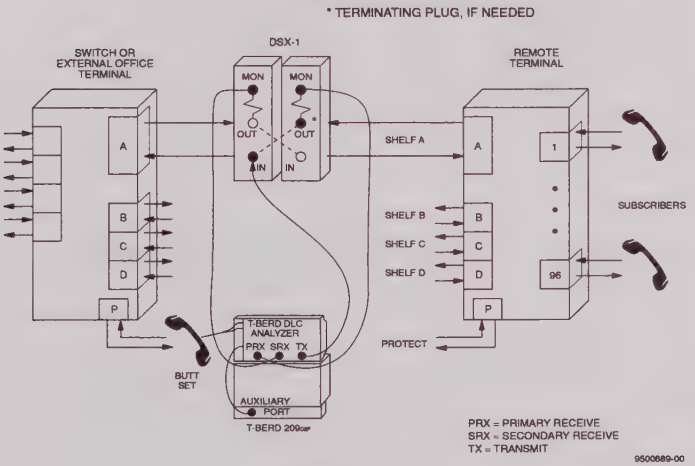



Figure 28
Testing Channel Signaling and VF Continuity

### *T-BERD 209OSP Mainframe Test Setup*

1. **Connect DLC Analyzer Option cable**
   Connect this cable to the T-BERD 209*OSP* AUXILIARY PORT connector.

   NOTE: If operating on battery power, turn off the T-BERD 209*OSP* before connecting the cable from the DLC Analyzer Option. This conserves battery power for increased operating time.

### *DLC Analyzer Option Test Setup*

2. **AUX switch**

Set the following auxiliary functions as follows:

Select the PRIMARY RECEIVE input to monitor the DS0 channels from the RT. Select BOTH receiver inputs when both sides of the line require monitoring.

| **CHANNEL** | **↑ select ↓** |
|---|---|
| **VF DROP** | **PRIMARY** |

Select either loop start or ground start trunk type.

| **CHANNEL** | **↑ select ↓** |
|---|---|
| **TRUNK TYPE** | **PRIMARY** |

Set the CHANNEL SCROLL auxiliary function to either BOTH to scroll the **PRIMARY** and **SECONDARY CHANNEL** switches together, or SEPARATE to allow them to scroll channel numbers separately.

| **CHANNEL** | **↑ select ↓** |
|---|---|
| **CHANNEL SCROLL** | **BOTH** |

| | |
|---|---|
| **TRANSMIT** | **↑ select ↓** |
| **LBO** | **0 dB** |

NOTE: If testing from the CO to the RT, set the LBO to 0 dB. If testing at the RT, set the LBO to -15 dB.

3. **AUX switch**
   Exit auxiliary functions.

4. **FRAME switch**
   Select SLC-M1 mode.

5. **SECONDARY CHANNEL switch**
   Set this switch to the double dashes (— —). This prevents the DLC Analyzer Option from inserting its own channel signaling into a channel.

6. **FORMAT switch**
   Select CHANNEL format.

7. **B8ZS switch**
   Select the appropriate coding (AMI or B8ZS).

8. **2-Wire VF Interface**
   Connect butt-set to the 2-wire VF posts near the RS-232 interface. Leave the butt-set **MON/TALK** switch in the MON or released position.

9. **RECEIVE INPUT switch and PRIMARY RECEIVE jack**
   Select the DSX-MON input level. Connect a cable between this jack and the T1 line as follows:

   - If at the CO, plug a cable between this jack and the Shelf A span-side DSX-1 MON jack.
   - If at the RT, plug a cable between this jack and the Shelf A equipment-side DSX-1 MON jack.

10. **SECONDARY RECEIVE jack**

Connect a cable between this jack and the T1 line as follows:

- If at the CO, plug a cable between this jack and the Shelf A equipment-side DSX-1 MON jack.
- If at the RT, plug a cable between this jack and the Shelf A span-side DSX-1 MON jack.

11. **TRANSMIT jack**

Plug the cable into the DLC Analyzer Option first, then plug the cable in as follows:

- If at the CO, plug a cable between this jack and the Shelf A equipment-side DSX-1 IN jack.
- If at the RT, plug a cable between this jack and the Shelf A span-side DSX-1 IN jack.
- If the DSX-1 MON jack is not properly terminated, install a 100-ohm terminating plug in the DSX-1 OUT jack as shown in Figure 27.

NOTE: You may notice a brief service interruption when you plug the cable into the DSX-1 IN jack.

12. **RESTART switch**

Clear the results and start the test.

13. **Status LEDs**

Both primary and secondary LEDs should illuminate: T1 Pulses, Frame Sync, and B8ZS (if applicable). The Alarms LED may illuminate.

14. **RESULTS I test results**

If errors or alarms are not detected, *ALL RESULTS OK* appears. If errors or alarms are detected, scroll through the SUMMARY category for specific errors or alarms. Check each category as required.

**ALL RESULTS**
**OK**

15. **SOURCE I switch**
Set **SOURCE I** to VF INTF.

16. **INSERT switch**
Press this switch to insert signaling from the 2-wire VF interface. The switch LED illuminates while in the insert mode.

17. **SECONDARY CHANNEL switch**
Select the desired DS0 channel. When the channel is selected the DLC Analyzer Option takes control of the channel's signaling.

18. **DS0 channel results interpretation**
***P VF LEVEL, P VF FREQ, P DATA BITS, and DTMF SEQ***
Verify that the VF signal level and frequency are within specifications. Verify that a data bit is not stuck. Monitor the DTMF dialing sequences.

NOTE: The VF LEVEL and VF FREQ test results are only valid when the CHANNEL VF DROP auxiliary function is set to either PRIMARY or SECONDARY.

***P TRAFFIC CHANNEL AB, P TRAFFIC CHANNEL ABCD, P TRAFFIC TIMESLOT, and P TS CHAN***
For all framing formats except SLC-M2, monitor the channel signaling bits. For the SLC-M2 framing format, monitor the timeslot traffic and the timeslot channel assignments originating from the central office terminal (only valid source of SLC-M2 timeslot channel assignments).

19. **OFF HOOK switch**
Press this switch to place channel off hook. Note that a dial tone is heard from the speaker. The switch LED illuminates while in the off-hook state.

20. **Butt-set**
Press the **MON/TALK** switch to the TALK position. Verify that a dial tone is heard.

Dial the telephone number. Verify that ringing is heard and the telephone is answered.

Press the **MON/TALK** switch to the MON position.

21. **ON HOOK switch**
Press this switch to place channel on hook. Note that a dial tone is not heard from the speaker. The switch LED illuminates while in the on-hook state.

### *Disconnect the DLC Analyzer Option*

22. **SECONDARY CHANNEL switch**
Set this switch to the double dashes ( — — ). This prevents the DLC Analyzer Option from inserting its own channel signaling into a channel.

23. **INSERT switch**
Press this switch to disconnect the butt-set from the line. The switch LED goes out.

24. **TRANSMIT jack**
Remove the 100-ohm terminating plug, if installed. Unplug the cable from the DSX-1 IN jack first. Then unplug the cable from the DLC Analyzer Option.

NOTE. You may notice a brief service interruption when you unplug the cable from the DSX-1 IN jack.

25. **PRIMARY RECEIVE and SECONDARY RECEIVE jacks**
Unplug the cables from the DSX-1 MON jacks, then the DLC Analyzer Option.

## 26. In-Service Shelf Bit Error Rate Testing
### *DLC Analyzer Option Required*

- Verify the alarm, switch to protection, and far-end loop response capabilities of the RT.

- Perform a switch to protection line and test the selected shelf.

Figure 29 illustrates the DLC Analyzer Option and T-BERD 209*OSP* testing the RT from the CO DSX-1 access point.

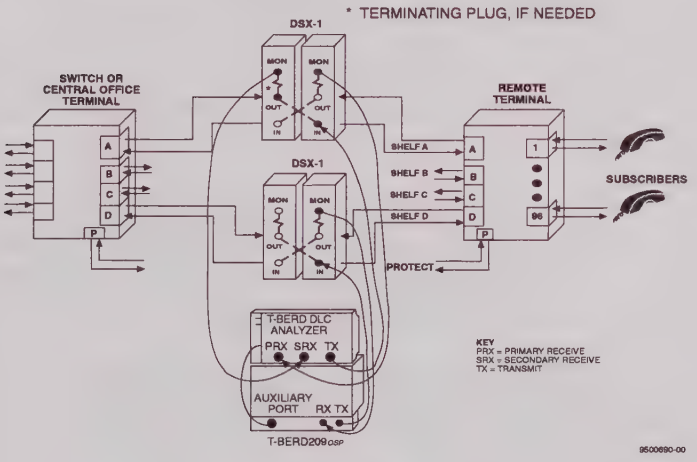



Figure 29
In-Service Shelf Testing

### *T-BERD 209OSP Mainframe Test Setup*

1. **Connect DLC Analyzer Option cable**
   Connect this cable to the T-BERD 209*OSP* AUXILIARY PORT connector.

   NOTE: If operating on battery power, turn off the T-BERD 209*OSP* before connecting the cable from the DLC Analyzer Option. This conserves battery power for increased operating time.

### *DLC Analyzer Option Test Setup*

2. **AUX switch**

Set the following auxiliary functions as follows:

Select the PRIMARY RECEIVE input to monitor the DS0 channels from the RT. Select BOTH receiver inputs when both sides of the line require monitoring.

| | |
|---|---|
| **CHANNEL** | **↑ select ↓** |
| **VF DROP** | **PRIMARY** |

Set the CHANNEL SCROLL auxiliary function to either BOTH to scroll the **PRIMARY** and **SECONDARY CHANNEL** switches together, or SEPARATE to allow them to scroll channel numbers separately.

| | |
|---|---|
| **CHANNEL** | **↑ select ↓** |
| **CHANNEL SCROLL** | **BOTH** |

| | |
|---|---|
| **TRANSMIT** | **↑ select ↓** |
| **LBO** | **0 dB** |

NOTE: If testing from the CO to the RT, set the LBO to 0 dB. If testing at the RT, set the LBO to -15 dB.

3. **AUX switch**
   Exit auxiliary functions.

4. **FRAME switch**
   Select SLC-M1 mode.

5. **FORMAT switch**
   Select DATLINK format.

6. **B8ZS switch**
   Select the appropriate coding (AMI or B8ZS).

7. **RECEIVE INPUT switch and PRIMARY RECEIVE jack**
   Select the DSX-MON input level. Connect a cable between this jack and the T1 line as follows:

   - If at the CO, plug a cable between this jack and the Shelf A span-side DSX-1 MON jack.
   - If at the RT, plug a cable between this jack and the Shelf A equipment-side DSX-1 MON jack.

8. **SECONDARY RECEIVE jack**

Connect a cable between this jack and the T1 line as follows:

- If at the CO, plug a cable between this jack and the Shelf A equipment-side DSX-1 MON jack.
- If at the RT, plug a cable between this jack and the Shelf A span-side DSX-1 MON jack.

9. **TRANSMIT jack**

Plug the cable into the DLC Analyzer Option first, then plug the cable in as follows:

- If at the CO, plug a cable between this jack and the Shelf A span-side DSX-1 IN jack.
- If at the RT, plug a cable between this jack and the Shelf A equipment-side DSX-1 IN jack.
- If the DSX-1 MON jack is not properly terminated, install a 100-ohm terminating plug in the DSX-1 OUT jack as shown in Figure 25.

NOTE: You may notice a brief service interruption when you plug the cable into the DSX-1 IN jack.

10. **RESTART switch**

Clear the results and start the test.

11. **Status LEDs**

Both primary and secondary LEDs should illuminate: T1 Pulses, Frame Sync, and B8ZS (if applicable). The Alarms LED may illuminate.

12. **RESULTS I test results**

If errors or alarms are not detected, *ALL RESULTS OK* appears. If errors or alarms are detected, scroll through the SUMMARY category for specific errors or alarms. Check each category as required.

**ALL RESULTS**
**OK**

13. **SOURCE I and II switches**
    Select **SOURCE I** for FE LOOP and **SOURCE II** for SHELF D.

14. **INSERT switch**
    Press this switch to insert and send the far-end loop command to the RT. The switch LED illuminates while in the insert mode. Shelf D is automatically switched to the protection line and the Shelf D T1 line is looped back.

15. **Datalink results interpretation**
    ***Alarm Messages — P SHELF D ON PROT***
    This alarm indicates Shelf D is switched to the protection line and looped back to the CO.

### *T-BERD 209OSP Mainframe Test Setup*

16. **MODE switch**
    Select the T1 D4 mode.

17. **PATTERN switch**
    Select the appropriate test pattern.

18. **TIMING switch**
    Set to INT.

19. **RECEIVE INPUT switch and jack**
    Select the DSX-MON input level. Connect a cable between this jack and the T1 line as follows:

    - If at the CO, plug a cable between this jack and the Shelf D span-side DSX-1 MON jack.
    - If at the RT, plug a cable between this jack and the Shelf D equipment-side DSX-1 MON jack.

20. **LBO (dB) switch and TRANSMIT/TDR jack**
    Select the 0 dB output level. Connect a cable between the TRANSMIT/TDR jack and the T1 line as follows:

    - If at the CO, plug a cable between this jack and the Shelf D span-side DSX-1 IN jack.
    - If at the RT, plug a cable between this jack and the Shelf D equipment-side DSX-1 IN jack.

21. **Status LEDs**
    The T1 Pulses, Frame Sync, Pattern Sync and B8ZS (if applicable) LEDs should illuminate.

22. **RESULTS I test results**
    Select the SUMMARY category.

23. **ERROR INSERT switch**
    Press the switch five times to verify the logic errors are received and the T1 circuit is looped back.

24. **RESTART switch**
    Clear the results and start the test.

25. **RESULTS I test results**
    If errors or alarms are not detected, *ALL RESULTS OK* appears. If errors or alarms are detected, scroll through the SUMMARY category for specific errors or alarms. Check each category as required.

**ALL RESULTS**
**OK**

26. **Results interpretation**

***VIOLATIONS only***

These errors typically indicate a local T1 span problem caused by a bad splice, water on the cable, crosstalk, or defective DSX jacks.

***FRM ERRORS (CRC ERRORS if ESF framing)***

These errors typically indicate a span line problem between you and the last piece of transmission equipment that framed the signal.

***VIOLATIONS and FRM ERRORS (CRC ERRORS if ESF framing)***

These errors typically indicate a local T1 span problem caused by a bad splice, water on the cable, crosstalk, or defective DSX jacks.

***RX FREQ, Hz***

The DS1 received frequency should be 1.544 MHz ±77 Hz. If the frequency is out-of-specification, check the transmission equipment timing or the network synchronization.

***RX LEVEL (dBdsx)***

The received level should be -20 dBdsx ±3.5 dBdsx at resistor isolated DSX-1 MON jacks. Incorrect levels could be caused by a faulty T1 line card or poor cabling between the DSX jack and the equipment.

***Yellow Alarm LED***

This alarm LED indicates a problem in the transmission leg of the span.

***SPX CURRENT***

If simplex current is not 60 mA, the span should be checked for shorts, opens, and grounds.

### *Disconnect the Test Sets*

27. **T-BERD 209*OSP* — unplug the cables**

When the test is complete, unplug the cables from the Shelf D DSX-1 jacks.

28. **DLC Analyzer Option — INSERT switch**

Press this switch to release Shelf D from the far-end loopback and protection line.

29. **TRANSMIT jack**

Remove the 100-ohm terminating plug, if installed. Unplug the cable from the DSX-1 IN jack first. Then, unplug the cable from the DLC Analyzer Option.

NOTE: You may notice a brief service interruption when you unplug the cable from the DSX-1 IN jack.

30. **PRIMARY RECEIVE and SECONDARY RECEIVE jacks**

Unplug the cables from the DSX-1 MON jacks, then the DLC Analyzer Option.

## 27. Checking SLC Mode 2 Timeslot Mapping
### *DLC Analyzer Option Required*

- Verify the Mode 2 timeslot channel mapping.

Figure 30 illustrates the T-BERD DLC Analyzer Option testing the Mode 2 RT from the CO DSX-1 access point.

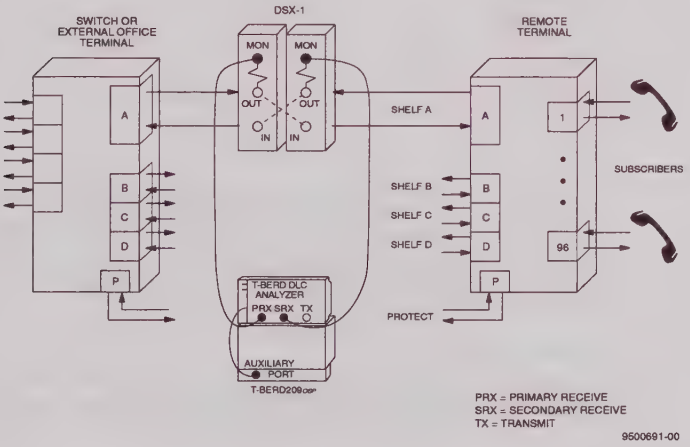



Figure 30
Checking SLC Mode 2 Timeslot Mapping

### *Connect DLC Analyzer Option to the T-BERD 209A/211*

1. **Apply power to power source**
   If the T-BERD 209A/211 is supplying power, turn power ON. If the external power supply is supplying power, plug external power supply into 110 VAC.

2. **Connect coiled cable**
   Connect the T-BERD DLC Analyzer Option coiled cable to either the T-BERD 209A/211 15-pin D connector or external power supply after applying power to the power source.

### *T-BERD DLC Analyzer Option Test Setup*

3. **AUX/FRAME/FORMAT switch**

   Select the CHANNEL/VF DROP auxiliary function to set which T1 line the DS0 channel is dropped from.

| | |
|---|---|
| **CHANNEL** | ↑ **select** ↓ |
| **VF DROP** | **BOTH** |

   Set to PRIMARY to drop the DS0 channel from the PRIMARY RECEIVE T1 signal. Set to SECONDARY to drop the DS0 channel from the SECONDARY RECEIVE T1 signal. Set to BOTH to drop the DS0 channel from both T1 signals.

4. **FORMAT switch**

   Select the CHANNEL/CHANNEL SCROLL auxiliary function to set the **PRIMARY** and **SECONDARY CHANNEL** switch control.

| | |
|---|---|
| **CHANNEL** | ↑ **select** ↓ |
| **CHANNEL SCROLL** | **BOTH** |

   Set to BOTH to scroll the **PRIMARY** and **SECONDARY CHANNEL** switch numbers simultaneously. Set to SEPARATE to scroll the switch numbers independently.

5. **FRAME switch**

   Select TRANSMIT/LBO to set the LBO level. If transmitting into the span, set the LBO for 0.0 dB. If transmitting into the equipment, set the LBO for -15.0 dB.

| | | | |
|---|---|---|---|
| **TRANSMIT** | ↑ | **select** | ↓ |
| **LBO** | | **0 dB** | |

6. **AUX switch**
   Exit auxiliary functions.

7. **FRAME switch**
   Select SLC-M2 mode.

8. **CODE switch**
   Select the appropriate coding.

9. **RECEIVE INPUT switch and PRIMARY RECEIVE jack**
   Select the DSX-MON input level. Connect a cable between this jack and the T1 line as follows:

   If at the CO, connect a cable between this jack and the Shelf A equipment-side DSX-1 MON jack.

   If at the RT, connect a cable between this jack and the Shelf A span-side DSX-1 MON jack.

10. **SECONDARY RECEIVE jack**
    Connect a cable between this jack and the T1 line as follows:

    If at the CO, connect a cable between this jack and the Shelf A span-side DSX-1 MON jack.

    If at the RT, connect a cable between this jack and the Shelf A equipment-side DSX-1 MON jack.

11. **RESTART switch**
    Clear the results and start the test.

12. **Status LEDs**

The following primary and secondary LEDs should illuminate: T1 Pulses, Frame Sync, and B8ZS (if applicable). The Alarms LED may illuminate.

13. **RESULTS I switches**

Select the CHANNEL category P TS CHAN result. Determine which timeslot or channel you want to monitor. The timeslots are indicated across the top line. The active timeslots have the mapped channel number below it. The "— —" indicates an unassigned timeslot.

| P TS | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CHAN | 01 | 03 | 05 | 07 | 10 | 22 | -- | 24 | -- | 36 | -- | -- |

Press the **RESULTS I Results** switch to scroll to timeslots 13 to 24.

| P TS | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CHAN | 04 | -- | -- | 15 | 20 | 12 | -- | 02 | -- | 11 | -- | -- |

NOTE: Only valid timeslot channel assignments can be monitored from the CO.

14 **PRIMARY CHANNEL switch**

Select the channel you want to monitor by displaying the *timeslot* number in the channel display. For example, to monitor channel 04 above, press the **PRIMARY CHANNEL** switch to display timeslot 13, monitor channel 15 by displaying timeslot 16.

15. **RESULTS I Results switch**

Select the CHANNEL category P/S TRAFFIC TIMESLOT AB result to monitor the timeslot signaling bits.

| | | | | | | |
|---|---|---|---|---|---|---|
| P TRAFFIC | A | 101010 | 101010 | 101010 | 101010 |
| TIMESLOT | B | 101010 | 101010 | 101010 | 101010 |

16. **SLC-M2 channel results interpretation**

***P TS CHAN***

The top row of numbers indicate the available timeslots. The bottom row of numbers identify the assigned channel of an active timeslot. An unassigned timeslot is indicated by two dashes (— —). An unknown timeslot assignment is left blank. The result is automatically updated as channels assignments and traffic change. Press the **RESULTS I Results** switch to display the PRIMARY (P) timeslot channel assignments.

***P/S TRAFFIC TIMESLOT AB***

This result displays the A and B signaling bits in all 24 timeslots from a single receiver input. Press the **RESULTS I Results** switch to display either the PRIMARY (P) or SECONDARY (S) signaling traffic.

NOTE: The **ABCD** switches are functional in all frame modes. However, the **ON HOOK**, **OFF HOOK**, and **RING** switches are not functional in the SLC-M2 mode.

## *Disconnect the T-BERD DLC Analyzer Option*

17. **PRIMARY RECEIVE and SECONDARY RECEIVE jacks**

Disconnect the cables from the DSX-1 MON jacks, then the T-BERD DLC Analyzer Option.

# ISDN/DDS LOCAL TESTING

## Digital Data Service (DDS) Local

## ISDN NOCAL Loop Testing

# DIGITAL DATA SERVICE (DDS) LOCAL LOOP TESTING

## 28. Digital Data Service (DDS) Local Loop Testing
***ISDN/DDS Analyzer Option Required***

- Qualifies DDS local loop error performance, between the main distribution frame and the customer demarcation point, by testing for logic errors and BPVs on the DDS local loop.

- If a repeater is in the loop, the ISDN/DDS Analyzer at the main distribution frame supplies span power (the ISDN/DDS Analyzer at the main distribution frame must be powered from the AC Line, not the AUX port of the 209*OSP*).

### *T-BERD 209OSP Mainframe Test Setup*

**Connect ISDN/DDS Analyzer Option cable**
Connect this cable to the T-BERD 209*OSP* AUXILIARY PORT connector. The T-BERD 209*OSP* only provides power to the ISDN/DDS Analyzer Option. If the DDS loop to be tested contains a repeater, the ISDN/DDS Analyzer Option at the main distribution frame must be powered from the AC line, not from the T-BERD 209*OSP*

NOTE: If operating on battery power, turn off the T-BERD 209*OSP* before connecting the cable from the ISDN/DDS Analyzer Option. This conserves battery power for increased operating time.

### *Setting Up the Central Office Site ISDN/DDS Analyzer*

1. **AUX, MODE, and FORMAT switches**
Set the RESPONSE auxiliary function to OFF position.

| | |
|---|---|
| **AUX RESPONSE** | **RESPONSE OFF** |

2. **AUX switch**
   Exit the auxiliary functions.

3. **MODE switch**
   Select DDS mode.

4. **FORMAT switch**
   Select the appropriate data rate. Selections include: 2.4 kB/s, 4.8 kB/s, 9.6 kB/s, 19.2 kB/s, 56.0 kB/s, or 64.0 kB/s.

5. **PRI PATTERN switch**
   Select the appropriate pattern. Selection include: ALL ONES, 63, 511, 2047, DDS-1, DDS-2, DDS-3, DDS-4, or DDS-5.

6. **SEC PATTERN switch**
   Select the appropriate pattern. Selection include: 63, 511, or 2047. If no pattern is selected, the secondary channel is deactivated.

7. **RECEIVE INPUT switch**
   Set the **RECEIVE** input switch to TERM.

8. **RECVD switch**
   Set to OFF.

9. **LBO switch**
   Set to 0 dB.

10. **Cable Connections**
    - Connect the output cable to either the TRANSMIT/ISDN jack or the LINE jack, as required.
    - Connect the input cable to either the RECEIVE jack or the LINE jack, as required.

11. **SPAN CURR switch**
    Set to 43 mA if a repeater is present in the loop. If no repeater is present, but loopback testing is required, set to 20 mA. If no repeater is present and loopback testing is not required, set to OFF.

12. **RESTART switch**
    Clear the results and start the test.

13. **Status LEDs**
    These LEDs should illuminate: PULSES, PRI PATTERN, and SEC PATTERN (if applicable). If the ERROR LED is illuminated, refer to the Results Display to determine the cause.

14. **RESULTS I test results**
    If errors or alarms are not detected, *ALL RESULTS OK* appears. If errors or alarms are detected, scroll through the SUMMARY category for specific errors or alarms. Check each category as required.

**ALL RESULTS**
**OK**

### *Setting Up the Customer Premise ISDN/DDS Analyzer*

1. **AUX, MODE, and FORMAT switches**
   Set the RESPONSE auxiliary function to the OFF position.

2. **AUX switch**
   Exit the auxiliary functions.

3. **Cable Connections**

   - Connect the output cable to either the TRANSMIT/ISDN jack or the LINE jack, as required.
   - Connect the input cable to either the RECEIVE jack or the LINE jack, as required.

4. **MODE switch**
   Select DDS mode.

5. **FORMAT switch**
   Select the AUTO format mode.

6. **RECEIVE INPUT switch**
   Set the **RECEIVE** input switch to TERM.

7. **RECVD switch**
   Set to ON.

8. **LBO switch**
   Set to 0 dB.

9. **FORMAT and PATTERN windows**
   The transmitted format and pattern will be displayed in these windows in lower case letters upon successful completion of AUTO configuration.

10. **RESTART switch**
    Clear the results and start the test.

11. **Status LEDs**
    These LEDs should illuminate: PULSES, PRI PATTERN, and SEC PATTERN (if applicable). If the ERROR LED is illuminated, refer to the Results Display to determine the cause.

12. **RESULTS I test results**

If errors or alarms are not detected, *ALL RESULTS OK* appears. If errors or alarms are detected, scroll through the SUMMARY category for specific errors or alarms. Check each category as required.

**ALL RESULTS**
**OK**

ISDN LOCAL LOOP TESTING

## 29. ISDN Local Loop Testing
### *ISDN/DDS Analyzer Option Required*

- Qualifies Basic Rate ISDN local loop error performance, between the main distribution frame and the customer demarcation point, by testing for logic errors on the ISDN local loop.

- If a repeater is in the loop, the ISDN/DDS Analyzer at the main frame supplies span power (the Analyzer at the main frame must be powered from the AC Line, not the AUX port of the 209*OSP*).

### *T-BERD 209OSP Mainframe Test Setup*

**Connect ISDN/DDS Analyzer Option cable**

Connect this cable to the T-BERD 209*OSP* AUXILIARY PORT connector. The T-BERD 209*OSP* only provides power to the ISDN/DDS Analyzer Option. If the ISDN loop to be tested contains a repeater, the ISDN/DDS Analyzer Option at the main distribution frame must be powered from the AC line, not from the T-BERD 209*OSP*

NOTE If operating on battery power, turn off the T-BERD 209*OSP* before connecting the cable from the ISDN/DDS Analyzer Option. This conserves battery power for increased operating time.

### *Setting Up the Central Office Site ISDN/DDS Analyzer*

1. **MODE switch**
   Select ISDN mode.

2. **FORMAT switch**
   This switch is disabled in ISDN mode and 160 kB/s is displayed in the FORMAT position.

3. **PRI PATTERN switch**
   Select the appropriate pattern. Selection include: ALL ONES, 63, 511, or 2047.

4. **RECEIVE INPUT switch**
   This switch is locked in the TERM position in ISDN mode.

5. **RECVD switch**
   Set to OFF.

6. **LBO switch**
   This switch is locked in the 0 dB position in ISDN mode.

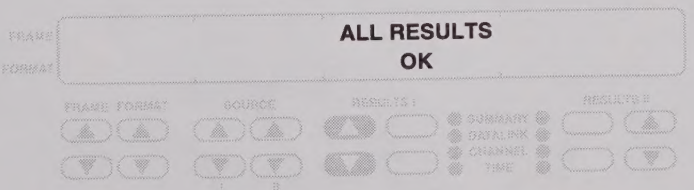
7. **Cable Connections**
   Connect the cable to either the TRANSMIT/ISDN jack or the LINE jack, as required.

8. **SPAN CURR switch**
   Set to 43 mA if a repeater is present in the loop.

9. **RESTART switch**
   Clear the results and start the test.

10. **Status LEDs**
    These LEDs should illuminate: PULSES and PRI PATTERN. If the ERROR LED is illuminated, refer to the Results Display to determine the cause.

11. **RESULTS I test results**
    If errors or alarms are not detected, *ALL RESULTS OK* appears. If errors or alarms are detected, scroll through the SUMMARY category for specific errors or alarms. Check each category as required.



### *Setting Up the Customer Premise ISDN/DDS Analyzer*

1. **MODE switch**
   Select ISDN mode.

2. **FORMAT switch**
   This switch is disabled in ISDN mode and 160 kB/s is displayed in the FORMAT position.

3. **RECEIVE INPUT switch**
   This switch is locked in the TERM position in ISDN mode.

4. **RECVD switch**
   Set to ON.

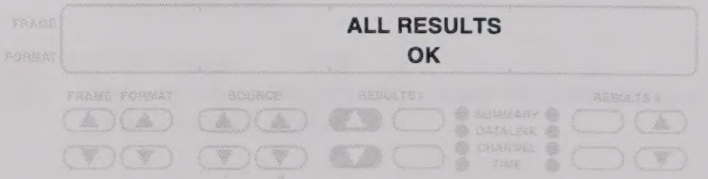
5. **LBO switch**
   This switch is locked in the 0 dB position in ISDN mode.

6. **Cable Connections**
   Connect the cable to either the TRANSMIT/ISDN jack or the LINE jack, as required.

7. **RESTART switch**
   Clear the results and start the test.

8. **Status LEDs**
   These LEDs should illuminate: PULSES and PRI PATTERN. If the ERROR LED is illuminated, refer to the Results Display to determine the cause.

9. **RESULTS I test results**
   If errors or alarms are not detected, *ALL RESULTS OK* appears. If errors or alarms are detected, scroll through the SUMMARY category for specific errors or alarms. Check each category as required.



Telecommunications
Techniques
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MP MASTER
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TTC™
*A Dynatech Company*

**Telecommunications Techniques Corporation**
20400 Observation Drive, Germantown, Maryland 20876
Tel. (800) 638-2049 • (301) 353-1550 (MD) • FAX (301) 353-9216
WWW Address: http://www.ttc.com